SIEMENS

SIMATIC HMI

Communication for Windows-based Systems

User's Manual

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We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

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Preface

Purpose

The Communication User's Manual describes:

- the structure and function of the individual user data areas,
- the different types of connection between the operating unit and the PLC,
- the actions that need to be carried out in the PLC program.

The description applies to operating units configured with ProTool/Pro.

Notation

The following notation is used throughout this manual:

VAR_23	Text that is displayed on the screen is printed in Courier typeface. This includes: commands, file names, entries in dialog boxes and system messages.
Tag	The names of dialog boxes and boxes and buttons in dialog boxes are printed in italics.
File → Edit	Menu items are shown linked by arrows. The full path to the menu item in question is always shown.
F1	The names of keys are printed in a different typeface.

History

Refer to the following table for information on the edition of the Communication User's Guide.

Edition	Comments
07/98	1st version for Windows–based system
01/99	Addition of PROFIBUS-DP connection for SIMATIC S5 and SIMATIC 505. Addition of the driver WinLC (new register). SIMATIC 505 with NITP and Allen Bradley DF1 have new configuration parameters and support different data types than previously. MP270 now included.

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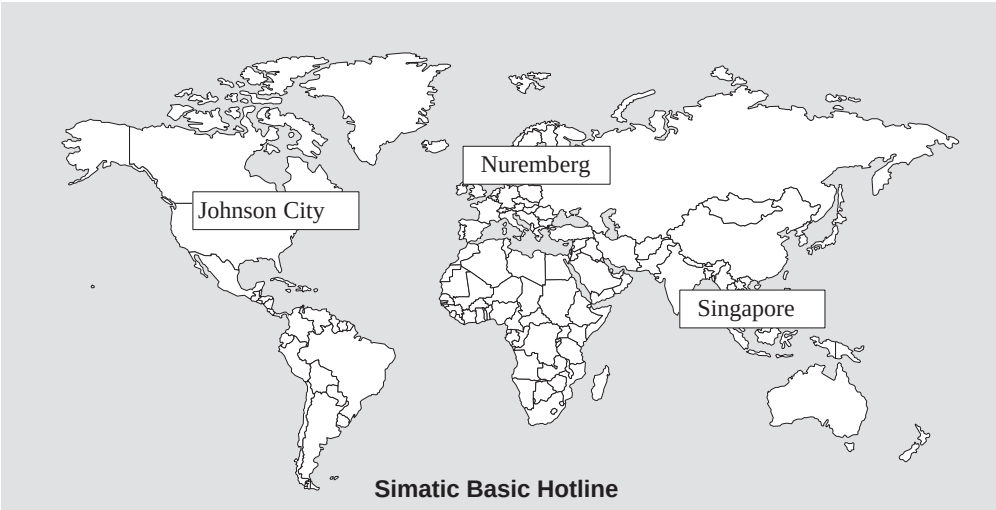

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Abbreviations

The abbreviations used in the *Communication User's Guide* have the following meaning:

AG	Programmable Logic Controller SIMATIC S5
AM	Alarm Message
AS511	Interface 511
ASCII	American Standard Code for Information Interchange
ANSI	American National Standards Institute
CP	Communication Processor
CPU	Central Processing Unit
DB	Data Block (on PLC)
DP	Decentral Periphery
DHB	Data Handling Block
DW	Data Word (on PLC)
DX	Extended data block (on PLC)
EM	Event Message
EPROM	Erasable (by UV light) Programmable Read–Only Memory
FB	Function Block
FW	Firmware
LED	Light Emitting Diode
MPI	Multipoint Interface (SIMATIC S7)
MW	Memory Word (on PLC)
OB	Organization Block
OP	Operator Panel
PC	Personal Computer
PLC	Programmable Logic Controller
PPI	Point–to–Point Interface (SIMATIC S7)
PU	Programming Unit
RAM	Random Access Memory (system memory)
SRAM	Static RAM (buffered)

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Part I General Information

Types of Connection

1

This chapter provides an overview of the possible types of connection between the operating units on the one hand, and the various PLCs on the other.

The most important features of the individual types of connection are described briefly according to the PLC used.

Please refer to the corresponding chapters in Parts II and VI of this manual for detailed information on each connection type, including specific notes on connection configuration.

1.1 Overview

Function of the operating units

Messages and tags are read in, displayed, stored and recorded on the operating units. The operating units can also be used to intervene in the process.

The term *operating unit* is used throughout this manual when describing settings which are relevant to the OP37/Pro, MP270 or PCs.

Data exchange

A condition for the operating and monitoring functions is the connection of the operating unit to a PLC. The exchange of data between the operating unit and the PLC is controlled by a connection-specific communication driver. Each type of connection requires its own communication driver.

PLC

PLCs used may be:

- SIMATIC S5
- SIMATIC S7,
- SIMATIC WinLC
- SIMATIC 505,
- Allen Bradley SLC 500 / PLC-5.

Selecting the type of connection

Criteria for selecting the type of connection between the operating unit and PLC include:

- the type of PLC,
- the CPU on the PLC,
- the type of operating unit,
- the number of operating units per PLC,
- the structure of and, if applicable, the bus system used by an existing installation,
- the work and expense involved in any additional components required.

Possible connection types

The following connection types are supported at present:

- **SIMATIC S5**
  - AS511 connection
  - PROFIBUS-DP connection
- **SIMATIC S7**
  - Multipoint interface (MPI) connection
  - PROFIBUS-DP connection
- **SIMATIC WinLC**
- **SIMATIC 505**
  - NITP protocol
  - PROFIBUS-DP connection
- **Allen Bradley SLC 500 / PLC-5**
  - DF1 protocol

1.2 Which Connection for Which Operating Unit

Selection criteria

Table 1-1 provides an overview of the various operating units. The decisive factors in making the correct choice are the type of PLC used and the existing network configuration. Tables 1-2, 1-3, 1-4 and 1-5 indicate the connection possibilities in respect of the different PLCs.

Table 1-1 Possible types of connection with operating units

PLC	Networks supported (protocol)	PC	OP37/Pro	MP270
SIMATIC S5	AS 511	x	x	x
	PROFIBUS–DP	x	x	x
SIMATIC S7	MPI (S7 protocol)	x	x	x
	PPI	1)	1)	1)
	PROFIBUS-DP (S7 protocol)	x	x	x
SIMATIC 505	NITP	x	x	x
	PROFIBUS–DP	x	x	x
Allen Bradley SLC 500 / PLC-5	DF1	x	x	x

1) Only possible with connection to an S7–212

x Possible

– Not possible

Table 1-2 Connection possibilities of the SIMATIC S5 PLCs

SIMATIC S5	AS511	PROFIBUS–DP
S5-90U	x	–
S5-95U	x	–
S5-95U DP–Master	x	x
S5-100U (CPU 100, 102, 103)	x	–
S5-115U (CPU 941-945)	x	x
S5-135U2)	x	x
S5-155U (CPU 946-948)	x	x

2) Only CPU 928A, version -3UA12 or later

x Possible without qualification

– Not possible

Table 1-3 Connection possibilities of the SIMATIC S7 PLCs

SIMATIC S7	PPI	MPI	PROFIBUS–DP [1]	Internal software
S7-200	x	x [2]	x	–
S7-300	–	x	x	–
S7-400	–	x	x	–
WinLC	–	–	–	x

[1] All CPUs with the designation "–2DP", CP or FM that support the S7 protocol
[2] Not S7-212
x Possible without qualification
– Not possible

Table 1-4 Connection possibilities of the SIMATIC 505 PLCs

SIMATIC 505	NITP	PROFIBUS–DP
505 Series	x	x

x Possible without qualification

Table 1-5 Connection possibilities of the Allen Bradley PLCs

Allen Bradley	DF1
SLC 500	x
PLC-5	x

x Possible without qualification

1.3 Conversion for Changing PLCs

Changing the PLC

If the PLC is changed in a configuration, ProTool cannot convert the data formats used by the old PLC for the new one. For this reason, the connection of the tags to the PLC are disconnected following a warning. If a tag is then called, the symbolic name *No PLC* is specified in the field PLC. This does not happen using ProTool when implementing a newer version of the PLC driver or when changing to a PLC within the same PLC family.

When is the connection to the PLC discontinued?

The connection of tags to the PLC is discontinued after changing the PLC as listed below:

Old PLC	New PLC
SIMATIC S5	SIMATIC S7–300/400; SIMATIC S7–200; WinAC; External driver
SIMATIC S7–300/400	SIMATIC S7–200; SIMATIC S5; SIMATIC 505; External driver
SIMATIC WinAC	SIMATIC S7–200; SIMATIC S5; SIMATIC 505; External driver
SIMATIC S7–200	SIMATIC S7–300/400; WinAC; SIMATIC S5; SIMATIC 505; External driver
SIMATIC 505	SIMATIC S5; SIMATIC S7–300/400; SIMATIC S7–200; WinAC; External driver
Allen Bradley	SIMATIC S5; SIMATIC S7–300/400; SIMATIC S7–200; WinAC; External driver

Same unit family

ProTool retains connection of the tags to the PLC when the changing to a PLC in the same unit family. If the old PLC uses data types which are not relevant for the new PLC, these are identified as invalid data formats and can be modified. This concerns the following PLCs:

- Changing the CPU using the SIMATIC S5 when different data formats are supported
- Changing from Allen Bradley SLC 500 to PLC 5 and vice versa
- Changing from SIMATIC S7–300/400 to WinAC and vice versa

Modifying data formats

Call in the dialog box for the tag with a double click. The old, invalid data format is displayed. Change the data format to a valid one.

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AS511 Connection 3

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Communication Management for SIMATIC S5

2

This chapter describes the basic communication between the operating unit and PLC.

Supported AGs

The following AGs are supported when connection via the AS511 and PROFIBUS–DP is used:

PLC	AS511	PROFIBUS–DP
PLC 90U	x	–
PLC 95U	x	x
AG 95U DP–Master	x	x
AG 100U (CPU 100, CPU 102, CPU 103)	x	–
AG 115U (CPU 941, CPU 942, CPU 943, CPU 944, CPU 945)	x	x
AG 135U (CPU 922, CPU 928A, CPU 928B)	x	x
AG 155U (CPU 945, CPU 946/947, CPU 948)	x	x

Supported operating units

The following operating units can be connected to the SIMATIC S5:

- PC
- OP37/Pro
- MP270

Installation

The drivers for connection to the the SIMATIC S5 are supplied with the configuration software and installed automatically. With ProTool, the parameters for connection to the PLC must also be set. Please refer to the corresponding chapter on connection types for information regarding which parameters are necessary on the PLC side to connect the operating unit.

Function block

The function blocks FB158 and FB159 are necessary for connection to PROFIBUS–DP, and are supplied with ProTool. These function blocks are examples and support linear P-addressing. The function blocks can be adapted for individual requirements at any time.

The function blocks are located in directory `PROTOOL\PLCPROG\SIMATIC_S5`. The function blocks to be implemented are dependent on the AG. Table 2-1 lists the directories for the various AGs. Copy all the files from the relevant directory in your STEP5 program.

Table 2-1 AG-dependent directories for function blocks

PLC	Directory
AG 95U DP–Master	`AG95UDP`
PLC 115U	`AG115U\CPU941_4` for CPU 941 bis 944 `AG115U\CPU945` for CPU 945
PLC 135U	`AG135U`
PLC 155U	`AG155U`

Behavior of ProTool V5.1

ProTool V5.1 does not support exactly the same data formats as ProTool V5.0x for some PLCs. However, it is still possible to used your configuration. After calling in the configuration using ProTool V5.1, the configuration window item object type *Tags* displays “invalid data format”. The configuration can be edited but not created. This concerns the PLC connection via PROFIBUS–DP.

Modifying data formats

Call in the dialog box for the tag with a double click. The old, invalid data format is displayed. Change the data format to a valid one.

2.1 Supported Data Types

When configuring tags and area pointers, the data types listed in Table 2-2 are available for use:

Table 2-2 Data types available

Data type	Addressed by	Format
Data block – word	DB DW	KF, KH, KM, KY, KC, KT, KZ, Bit
Data block – double word	DB DD	DF, DH, KC, KG, Bit
Extended data block – word[1)]	DX DW	KF, KH, KM, KY, KC, KT, KZ, Bit
Extended data block – double word[1)]	DX DD	DF, DH, KC, KG, bit
Input word	EW	KF, KH, KM, KY, KC, KT, KZ, Bit[2)]
Input double word	ED	DF, DH, KC, KG, Bit[2)]
Output word	AW	KF, KH, KM, KY, KC, KT, KZ, Bit[2)]
Output double word	AD	DF, DH, KC, KG, Bit[2)]
Marker word	MW	KF, KH, KM, KY, KC, KT, KZ, Bit[2)]
Marker double word	MD	DF, DH, KC, KG, Bit[2)]
Timer	T	KT, KH, KM
Counter	Z	KZ, KH, KM
SMarkerWord[1)]	SW	KF, KH, KM, KY, KC, KT, KZ, Bit
SMarkerDWord[1)]	SD	DF, DH, KC, KG, Bit

1) This data format is not supported by all CPUs and is not possible using PROFIBUS–DP

2) This data format is not supported by all CPUs

2.2 Optimization

Acquisition cycle and update time

The acquisition cycles defined in the configuration software for the *area pointers* and for the tags are major factors in respect of the real update times which are achieved. The update time is the acquisition cycle plus transmission time plus processing time.

In order to achieve optimum update times, the following points should be observed during configuration:

- When setting up the individual data areas, make them as large as necessary but as small as possible.
- Define data areas that belong together as contiguous areas. The real update time is improved by setting up one large are area instead of several small areas.
- Setting acquisition cycles which are too short unnecessarily impairs overall performance. Set the acquisition cycle to correspond to the modification time of the process values. The rate of change of temperature of a furnace, for example, is considerably slower than the acceleration curve of an electric motor.

  Guideline value for the acquisition cycle: Approx. 1 second.
- If necessary, dispense with cyclic transmission of user data areas (acquisition cycle = 0) in order to improve the update time. Instead, use PLC jobs to transfer the user data areas at random times.
- In order that changes on the PLC are reliably detected by the operating unit, they must occur during the actual acquisition cycle at least.

Screens

The real updating rate which can be achieved is dependent on the type and quantity of data to be displayed.

In order to achieve short updating times, ensure that short acquisition cycles are only defined in the configuration for those objects which actually need to be updated quickly.

Trends

If the communication bit is set in the *trend transfer area*, as in the case of bit-triggered trends, the operating unit always updates all the trends whose bit is set in that area. It resets the bits afterwards.

The communication bit in the S5 program may only be set again after all the bits have been reset by the operating unit.

PLC jobs

If a number of PLC jobs need to be transferred to the operating unit in quick succession, communication between the operating unit and AG may become overloaded.

If the operating unit enters the value 0 in the first data word of the job mailbox, it signifies that the operating unit has accepted the job. It then processes the job, for which it requires a certain amount of time. If a new PLC job is then immediately entered in the job mailbox, it may take some time before the operating unit executes the next PLC job. The next PLC job is only accepted when sufficient computer performance is available.

Read DB address list cyclically (AS511 only)

Reading the DB address list for each access to the AG is only necessary if, for example, the user data areas are modified during the startup phase. For subsequent operation, this function should be deactivated for performance reasons.

2.3 Error Prevention

Data block modification

Modification of the data block is not permitted when the system is in operation.

Neither is it permitted to compress the internal program memory of the AG (PU function “Compress”, integrated FB COMPR) when an operating unit is connected! The compressing process alters the absolute addresses of the blocks in the program memory. Since the operating unit only reads the address list at startup, it does not detect subsequent changes to the addresses and accesses the wrong memory areas.

If compression during normal operation cannot be avoided, the operating unit must be switched off before compression takes place.

In areas subject to explosion hazard, always disconnect the operating unit from the power supply before disconnecting connectors.

Operating unit connected to SI2 of the CPU

If both CPU interfaces are used for communication via the AS511, the second interface is operated with a lower priority. A possible configuration is, e.g.: PU on SI1 and operating unit on SI2. In this case, error messages may occur on the operating unit relating to a communication fault. In extreme cases, such characteristics may occur on the CPU928B .

AS511 Connection

3

This chapter describes the communication between the operating unit and SIMATIC S5 with the AS511 connection.

Installation

The driver for connection to the the SIMATIC S5 is supplied with the configuration software and installed automatically.

Connection of the operating unit to the SIMATIC S5 is basically restricted to the physical connection to the operating unit. Special function blocks for connection to the PLC are not required.

Connection

The operating unit is connected directly to the CPU. Please refer to Table 3-1 for information concerning the connection cable to be used. The CPU interface SI1 with the TTY physical characteristics should be used, preferably. The CPU interface SI2 with the TTY physical characteristics can also be used, if available. In the case of the SI2 interface, however, performance limitations must be taken into account.

Details of which interface to use on the operating unit are provided in the relevant equipment manual.

Table 3-1 Applicable connection cables

Operating unit	All CPUs
PC (COM1, COM2)	6ES5734-1BD20
OP37/Pro	6XV1440-2A_ _ _
MP270	6XV1440-2A_ _ _

'_' = Length code

3.1 Basic Methods of Functioning

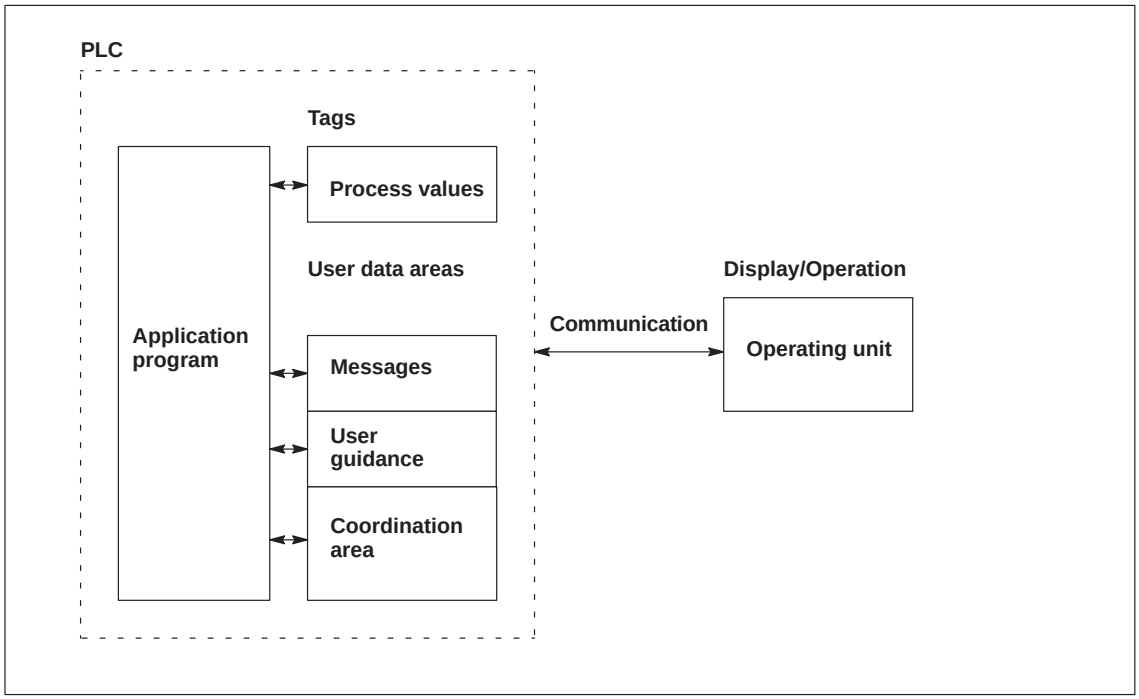


Figure 3-1 Communication structure

Task of the tags

The general data exchange between AG and operating unit is performed via process values. To do this, tags are created in the configuration which relate to an address in the AG. The operating unit reads the value from the specified address and displays it. In the same way, an operator can enter a value on the operating unit which is then written to the address in the AG.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data areas are required for:
- Messages,
- Trends,
- PLC jobs,
- Controlling LEDs,
- Life bit monitoring.

A detailed description of the user data areas is provided in Chapter 5.

3.2 Configuring SIMATIC S5 for AS511

When creating a new project, the project assistant requests the definition of the PLC. Select the driver `SIMATIC S5 AS511` and then define the parameters, indicated below, after clicking on the button *Parameter*. For any subsequent parameter modifications, select the item *PLC* in the project window.

Define the following parameters for the PLC:

Table 3-2 PLC parameters

Parameter	Explanation
CPU type	Select a SIMATIC S5 CPU.
Interface	Select the interface on the operating unit via which the connection is to be established. This is the interface IF1A when using the OP37/Pro and MP270. This can be interface COM 1 or COM 2 in the case of a PC.
Type Data bits Parity Stop bits Baud rate	These parameters are specifically defined for connection type AS511.
DB address	Select *Read DB address list cyclically*, the address list is read in anew following each operating unit read/write access in the AG. This is important during commissioning if modules are set up, modified or deleted in the PLC. **Note** The *Read DB address list cyclically* setting has a direct effect on the performance and should, therefore, not be used when the system is in operation.

PROFIBUS–DP Connection to SIMATIC S5 4

This chapter describes the communication between the operating unit and SIMATIC S5 via the PROFIBUS–DP.

Definition

PROFIBUS-DP is a Master-Slave field bus with up to 122 slaves. The PROFIBUS-DP network is normally operated by one master. This master polls all the slaves cyclically. The master is, for example, an AG with a standard DP–compatible connection module. Each operating unit is a slave and explicitly assigned to a master AG.

Hardware requirements

The following hardware components are required in order to integrate the operating units into an existing PROFIBUS–DP network:

- OP37/Pro, or
  MP270 or
  PC with communication processor CP5611 or CP5511
- In the AG:
  IM308C or
  CP5431
- For each unit (operating unit or AG):
  Bus connector PROFIBUS–DP or
  a different component approved for this installation (except FSK bus terminal, refer to Configuration in SIMATIC HMI Catalog ST80.1).

Software requirements

The following software components are also required for the PROFIBUS-DP connection:

- Configuration software ProTool/Pro from Version 5.1
- COM PROFIBUS 3.X

Installation

The driver for connection to the SIMATIC S5 is supplied with the configuration software and installed automatically.

For connection of the operating unit to the SIMATIC S5, both the physical connection and a function block in the PLC are required. The function block is supplied with ProTool/Pro.

Other bus masters

In special cases, it is possible to connect another AG with a standard DP–compatible master module to a PROFIBUS-DP network. The operating units can then be distributed between both masters.

System limits

Within a network established via the PROFIBUS-DP, a maximum of 120 of the 122 slaves may be an operating unit. These values are theoretical limits. The real limits are determined by the memory capacity and performance capability of the PLC.

4.1 Basic Methods of Functioning

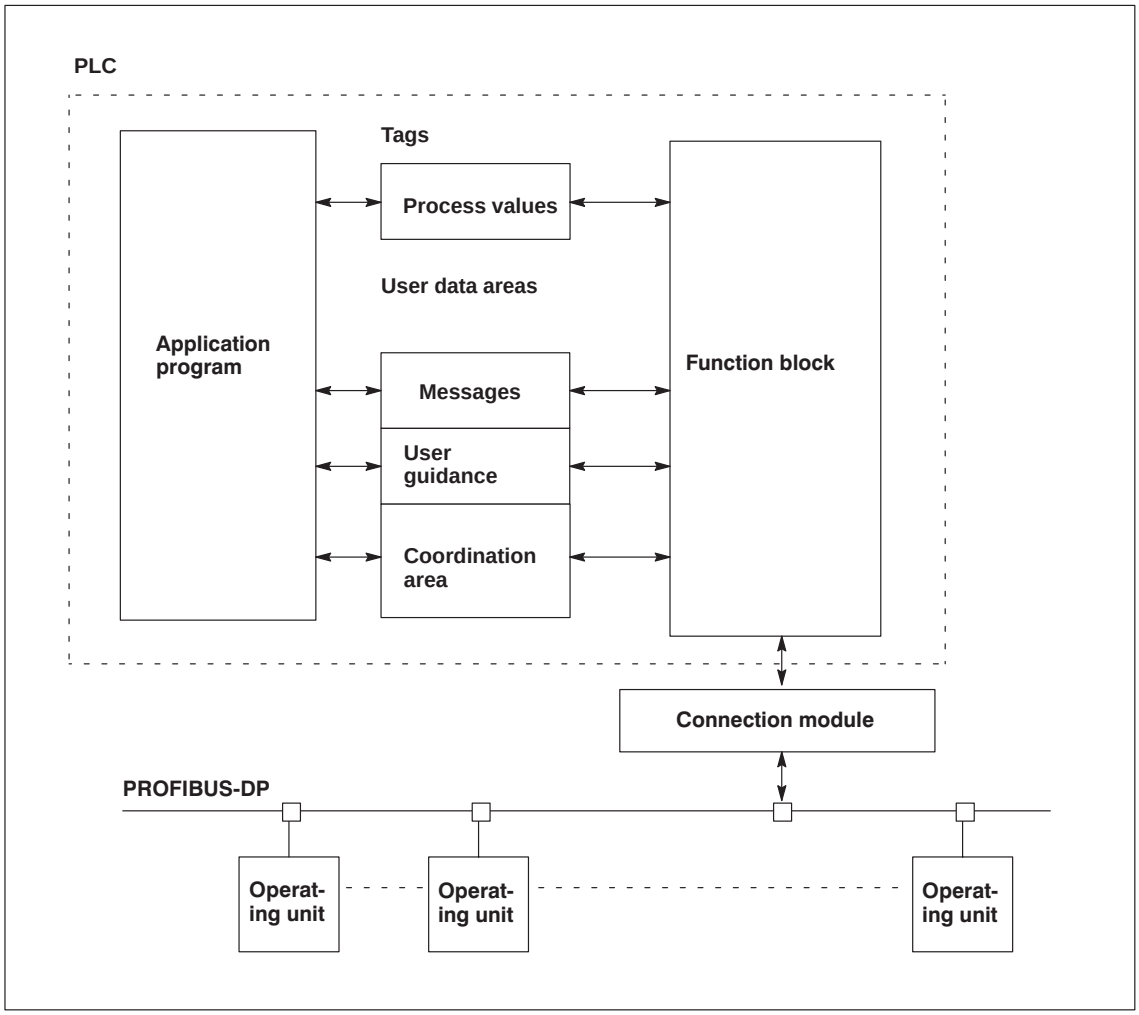


Figure 4-1 Communication structure of the PROFIBUS-DP connection

Task of the tags

The general data exchange between AG and operating unit is performed via process values. To do this, tags are created in the configuration which relate to an address in the AG. The operating unit reads the value from the specified address and displays it. In the same way, an operator can enter a value on the operating unit which is then written to the address in the AG.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data areas are required for:
- Messages,
- Trends,
- PLC jobs,
- Controlling LEDs,
- Life bit monitoring.

A detailed description of the user data areas is provided in Chapter 5.

Tasks of the function block

The operating unit and AG communicate via a PROFIBUS–DP master module. The function blocks FB158 and FB159 must be installed in the STEP5 application program. The task of the function blocks is to coordinate the data exchange and to monitor the connection to the operating unit. The FB158 is responsible for recording the process, the FB159 reads the data in and out of the memory.

Interface settings

The interface is setup as follows using Windows *Settings→ Control Panel → Set PU/PC interface*:

Access point of the application	DPSONLINE
Module configuration used	PROFIBUS–DP slave

4.2 Configuring the Function Block

Addressing the function block

The function blocks supplied with ProTool are examples and supports linear P–addressing. The function blocks can be adapted for individual applications at any time.

The following table explains which modifications are necessary for the respective types of addressing when both function blocks supplied, FB158 and FB159, are used.

Type of addressing	Modifications
Linear P–range	Not necessary
Linear Q–range	The P–addresses must be changed to Q–addresses in both FB158 and FB159.
P–page frame	Before calling the FB158, the page frame number must be entered in the periphery byte 255.
Q–page frame	Before calling the FB158, the page frame number must be entered in the periphery byte 255. The P–addresses must be changed to Q–addresses in both FB158 and FB159.

The following table indicates the permissible address range, according to the type of addressing, for all PLCc except S5 95U.

Type of addressing	Permissible address range
Linear P–range	128 to 255
Linear Q–range[1)]	0 to 255
P–page frame	192 to 254
Q–page frame[1)]	0 to 254

1) Only possible using S5 115U with CPU 945, S5 135U and S5 155U.

In the case of AG 95U, the permissible address range is between 64 and 191. Since the address 127 physically lies within a range different from address 128, a block may not be set up with overlapping ranges. This results in the address ranges 64 to 127 and 128 to 191.

Calling in FB158

The FB158 must be called in the cyclic program, e.g. OB1, with the following parameters:

- **PERA**:

  Periphery start address. It must correspond with the configuration in COM–PROFIBUS.

- **BLEN**:

  Block length. (Not with AG 95U, with which only ‘tiny’ is possible.)

  0: tiny
  1: small
  2: middle
  3: big

  The block length must correspond to the configuration in ProTool (*PLC → Parameter*).

- **CADB**:

  A free DB is used by the FB158 as working memory. The first 10 words of the DB are used by the FB158 to buffer data temporarily. This DB can be used by the user from the 11th data word.

After calling in the FB158, the number of any error which may have occurred appears in AKKU 1. This error must be analyzed in the STEP5 program because the error number is reset the next time an FB is called.

Multiple calling of the FB158

When using several units, the FB must be called in once for each unit.

Note

The performance is increased considerably when the FB158 is called in from a time-controlled OB.

4.3 Configuration of PROFIBUS–DP for ProTool

Parameter

When defining a new project, the project assistant requests the specification of a PLC. Select the driver `SIMATIC S5 DP V5.1` and then define the parameters, indicated below, after clicking on the button *Parameter*. For any subsequent parameter modifications, select the item *PLC* in the project window.

Define the following parameters for the PLC:

Table 4-1 PLC parameters

Parameter	Explanation
OP address	PROFIBUS–DP address of the operating unit. Value range 3 to 126
Interface	Select the interface on the operating unit via which the connection is to be established. When using a PC, this is `DP/MPI`, and with the OP37/Pro and MP270, `IF1B`. In the case of the OP37/Pro, ASPC2 must also be activated in the BIOS. In the mask *Integrated Peripherals*, set the OP37/Pro BIOS entry *ASPC2* to `Enabled`.
Baud rate	The baud rate at which communication takes place over the network. The baud rate must be set identically for all the units in the network. The following baud rates are possible: – 93.75 kBit/s – 187.5 kBit/s – 500 kBit/s – 1.5 MBit/s (default) – 3 MBit/s – 6 MBit/s – 12 MBit/s
Set configuration	Used to define the I/O area implemented for the communication area between the operating unit and AG. The size of the I/O area influences the performance. The set configuration must be realized according to Class B (realization of the basic DP slave complying to EN 50170). There are four different set configurations from which to choose: – Class B tiny – Class B small – Class B middle – Class B big Table 4-2 indicates the assignment of the I/O area.

The settings in ProTool/Pro must correspond to configuration specifications of the connection module IM308C.

Set configuration

The assignment of the I/O area is explicitly defined with the four different settings. Table 4-2 provides details of the I/O area assignment.

Table 4-2 Assignment of the I/O area for Class B

Class	Inputs (Byte)	Outputs (Byte)
Class B tiny	32	22
Class B small	42	22
Class B middle	64	32
Class B big	122	64

In order to download large quantities of data, it is recommended to set a large I/O area. This ensures the screen displays on the operating unit are updated more quickly because the data is retrieved in one cycle.

4.3.1 Other SIMATIC S5 PROFIBUS-DP Master Modules

Condition

The operating units can use PROFIBUS-DP to communicate with all the master modules which support PROFIBUS-DP complying to DIN E 19245, Part 3.

Notes on configuration

Please refer to the relevant module description for information on configuring other PROFIBUS–DP master modules. Observe the following performance data when connecting the operating unit to a PROFIBUS–DP network:

- Configure the operating unit as a PROFIBUS–DP slave, complying to DIN E 19245, Part 3.
- The address scope (block size) of the I/O area must be defined for each operating unit.
- Enter the corresponding manufacturer ID of the unit (refer to Table 4-4).
- The modes “SYNC” and “FREEZE” are not supported by the operating unit.
- User–configured data is not possible.
- Only use one of the following operating unit baud rates (disregard any other setting possibilities in the configuration software):
  - 93.75 KBit/s,
  - 187.5 KBit/s,
  - 500 KBit/s,
  - 1.5 MBit/s,
  - 3 MBit/s.
  - 6 MBit/s.
  - 12 MBit/s.
- A time of 3 ms must be set as the “Min. slave-interval” for all operating units.
- Configure the operating unit periphery address area as a combined I/O area with byte consistency. The combined I/O areas have the following Identifications:

Class	Identification
Class B tiny	0x3F, 0x35, 0x19
Class B small	0x3F, 0x35, 0x1F, 0x13
Class B middle	0x3F, 0x3F, 0x1F
Class B big	0x3F, 0x3F, 0x3F, 0x3F, 0x1F, 0x1F, 0x1F, 0x19

There are no other consistency requirements.

CP 5430 TF and CP 5431 FMS

The configuration user interface PROFIBUS–NCM is required to configure the communication processors CP 5430 TF (from version 2) and CP 5431 FMS (from version 1). The notes on configuration on Page 4-9 apply. Only the special features for the CP 5430/5431 are described here.

Please refer to the relevant module description for information on configuration of the communication processors using PROFIBUS–NCM.

We recommend setting the following parameters according to Table 4-3:

Table 4-3 Parameters recommended for PROFIBUS–NCM

Parameter	Setting
Bus parameter data	Apply “calculated parameters”
DP operating mode	Free running
Trigger monitoring	“Yes” applicable for operating unit
Polling cycle time	Min. 5 ms; as small as possible
Largest min. slave interval	3 ms

Only linear P–area is permissible for the type of addressing.

FB-SYNCHRON must be called in the start-up organization modules OB 20, OB 21 and OB 22:

Example call for SIMATIC S5–115U:

```
      :SPA FB 249      Call in HTB SYNCHRON
NAME  :SYNCHRON
SSNR  :KY 0.8          Interface  no. (page frame no.)
BLGR  :KY 0.5          Block size
PAFE  :MB 255          HTB error messages
```

4.4 Configuring the PROFIBUS–DP Network

Connection module IM308C

The configuration packet COM PROFIBUS is required in order to configure the IM308C. GSD files for operating unit slaves are supplied with ProTool/Pro. These GSD files are located in directory `\PROTOOL\PLCPROG\GSD`.

Different GSD files are required for the different operating units. Table 4-4 indicates the assignment.

Table 4-4 Assignment of GSD files and operating units

GSD file	Manufacturer ID	To 12 MBaud
SIEM8076.GSD	0x8076	PC
SIEM8077.GSD	0x8077	OP37/Pro
SIEM8078.GSD	0x8078	MP270

If the GSD files in the COM PROFIBUS directory `\PROTOOL\PLCPROG\GSD` are older than those supplied with ProTool/Pro, or the COM PROFIBUS still does not support a new operating unit, copy the files from ProTool to COM PROFIBUS. Then restart COM PROFIBUS and select `Read GSD files`.

If a COM PROFIBUS configuration was created previously with an older file but the new GSD files are required for use, the configuration must be re-created.

Parameters

In order that the IM308C and operating unit can communicate with each other, the following parameters must be set in COM PROFIBUS:

- **Station type**: *HMI*
- **Station number**: 3...126

  The value entered here must correspond with the OP address specified in the operating unit configuration.
- **Set configuration**:

  The set configuration is defined by selecting the class and the symbolic name of the name. The following set configurations can be set:
  - Class B tiny
  - Class B small
  - Class B middle
  - Class B big
- **Address ID**:

  The address ID is automatically assigned by the set configuration and must not be modified.
- **I and O address**:

  The address must correspond to the FB configuration (refer to Chapter 4.2).

User Data Areas for SIMATIC S5

5

User data areas are used for data exchange between the PLC and operating unit.

These data areas are written to and read by the operating unit and the application program alternately during the process of communication. By analyzing the data stored there, the PLC and operating unit reciprocally initiate predefined actions.

This chapter describes the function, layout and special features of the various user data areas.

5.1 Overview

Definition

User data areas can be located in data blocks and memory areas in the PLC. User data areas include messages and trends. Set up user data areas both in the configuration, using menu item *System* → *Area Pointer*, and in the PLC.

Function range

The user data areas available depend on the operating unit used. Table 5-1 summarizes the range of functions available on the individual operating units.

Table 5-1 Applicable user data areas

User data area	PC	OP37/Pro	MP270
Event messages	X	X	X
Alarm messages	X	X	X
Aknowledgement area	X	X	X
LED assignment	–	X	X
Trend request area	X	X	X
Trend transfer areas	X	X	X
Screen number	X	X	X
PLC jobs	X	X	X
Coordination area	X	X	X
Date and time	X	X	X

Table 5-2 indicates who is reading (**R**) and who is writing (**W**) in respect of access to the individual data areas.

Table 5-2 Use of data areas

Data area	Necessary for	Operating unit	PLC
Event messages	Configured event messages	R	W
Alarm messages	Configured alarm messages	R	W
PLC acknowledgement	Alarm message acknowledge-ment from the PLC	R	W
Operating unit acknowledgement	Message from the operating unit to the PLC indicating an alarm message has been acknowledged	W	R
LED assignment area (for OP and MP only)	LED triggeed by the PLC	R	W

Table 5-2 Use of data areas, continued

Data area	Necessary for	Operating unit	PLC
Trend request	Configured trends with “Triggering via bit” or configured history trends	W	R
Trend transfer 1	Configured trends with “Triggering via bit” or configured history trends	R/W	R/W
Trend transfer area 2	Configured history trend with “switch buffer”	R/W	R/W
Screen number	Evaluation by the PLC as to which screen is currently open	W	R
PLC jobs	Triggering of functions on the operating unit by PLC program	R/W	R/W
Coordination area	Operating unit status polled by the PLC program	W	R
Date and time	Transfer of date and time from the operating unit to the PLC	W	R

5.2 Event and Alarm Messages

Definition

Messages consist of a static text and/or tags. The text and tags can be defined by the user.

Messages are subdivided into event messages and alarm messages. The programmer defines the event message and alarm message.

Event message

An event message indicates a status, e.g.

- `Motor switched on`
- `PLC in manual mode`

Alarm message

An alarm message indicates an operational fault, e.g.

- `Valve not opening`
- `Motor temperature too high`

Acknowledgement

Since alarm messages indicate an abnormal operating status, they must be acknowledged. They can be acknowledged either by

- operator input on the operating unit
- setting a bit in the PLC acknowledgement area.

Triggering messages

A message is triggered by setting a bit in one of the message areas on the PLC. The location of the message areas is defined by means of the configuration software. The corresponding area must also be set up in the PLC.

As soon as the bit in the PLC event/alarm message area has been set and that area has been transferred to the operating unit, the operating unit detects that the relevant message has “arrived”.

Conversely, when the same bit is reset on the PLC by the operating unit, the message is registered as having “departed”.

Message areas

Table 5-3 indicates the number of message areas for event and alarm messages, the number of alarm message acknowledgement areas (PLC → Operating Unit and Operating Unit → PLC) and the total length of all the respective areas for the various operating units.

Table 5-3 Operating unit message areas

Unit	**Event message area**		**Alarm messages area/ Alarm message acknowledgement area**	
	Number	**Length** (words)	**Number per type**	**Overall length per type** (words)
PC	8	125	8	125
OP37/Pro	8	125	8	125
MP270	8	125	8	125

Assignment of message bit and message number

A message can be configured for each bit in the message area configured. The bits are assigned to the message numbers in ascending order.

Example:

Assume that the following event message area has been configured for the SIMATIC S5 PLC:

`DB 60 Address 43 Length 5` (in words)

Figure 5-1 shows the assignment of all 80 (5 x 16) message numbers to the individual bit numbers in the PLC event message area.

The assignment is performed automatically on the operating unit.

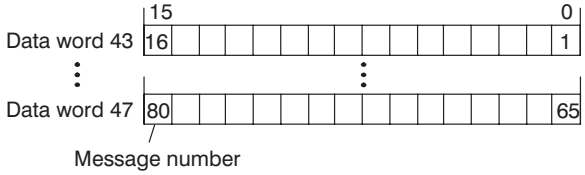


Figure 5-1 Assignment of message bit and message number

Acknowledgement areas

If the PLC should be informed of an alarm message acknowledgement on the operating unit or the acknowledgement should be initiated on the PLC itself, the relevant acknowledgement areas must be set up in the PLC. These acknowledgement areas must also be specified in the configuration.

- **Acknowledgement area Operating Unit → PLC**:
  This area is used to inform the PLC when an alarm message has been acknowledged by means of operator input on the operating unit. In this case, the area pointer “OP acknowledgement” must be set.
- **Acknowledgement area PLC → Operating Unit**:
  This area is used when an alarm message is acknowledged by the PLC. In this case, the area pointer “PLC acknowledgement” must be set.

These acknowledgement areas must also be specified in the configuration under *Area Pointers*.

Figure 5-2 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 5-4 and 5-5.

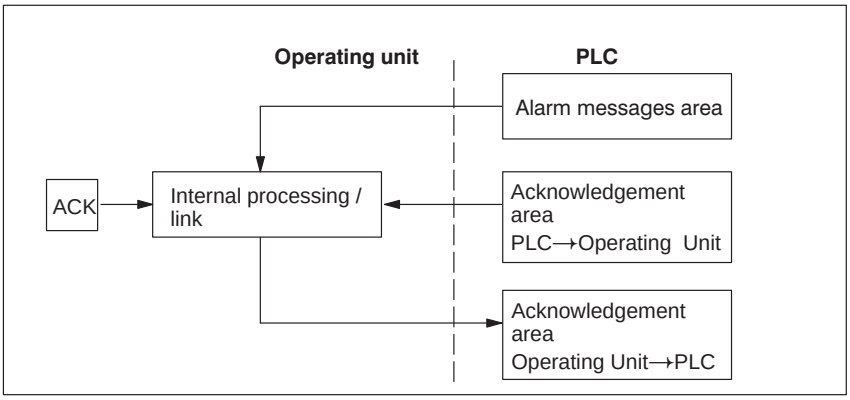


Figure 5-2 Alarm message and acknowledgement areas

Assignment of acknowledgement bit to message number

Each alarm message is assigned a message number. The message number is assigned the same bit number in the alarm messages area as that assigned in the acknowledgement area. Under normal circumstances, the acknowledgement area is the same length as the associated alarm messages area.

If the length of an acknowledgement area is not equal to the overall length of the associated alarm messages area, and there are succeeding alarm messages and acknowledgement areas, the following assignment applies:

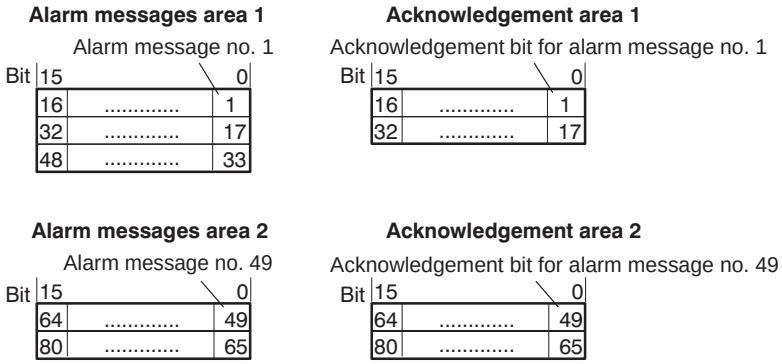


Figure 5-3 Assignment of acknowledgement bit and message number

Acknowledgement area PLC → Operating Unit

A bit set in this area by the PLC initiates the acknowledgement of the corresponding alarm message in the operating unit, thus fulfilling the same function as pressing the “ACK” key. Reset the bit before setting the bit in the alarm message area again. Figure 5-4 shows the signal diagram.

The acknowledgement area PLC→ Operating Unit

- must follow on immediately from the associated alarm messages area,
- must have precisely the same polling time and
- may not be any longer than the associated alarm messages area.

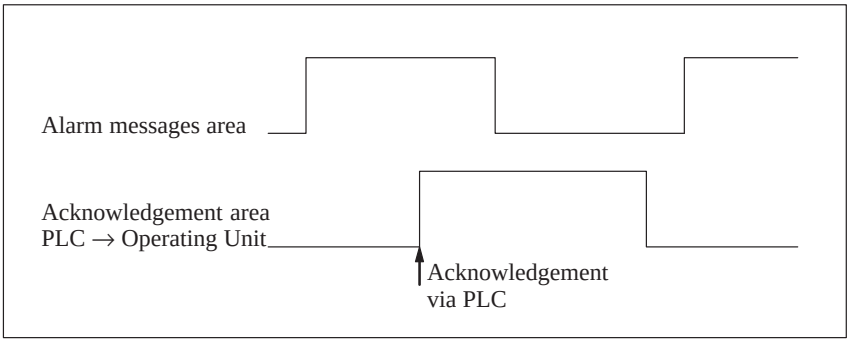


Figure 5-4 Signal diagram for acknowledgement area PLC → Operating Unit

Acknowledgement area Operating Unit → PLC

When a bit is set in the alarm message area, the operating unit resets the associated bit in the acknowledgement area. As a result of processing by the operating unit, the two processes indicate a slight difference with regard to time. If the alarm message is acknowledged on the operating unit, the bit in the acknowledgement area is set. In this way, the PLC can detect that the alarm message has been acknowledged. Figure 5-5 shows the signal diagram.

The acknowledgement area Operating Unit → PLC must be no longer than the associated alarm messages area.

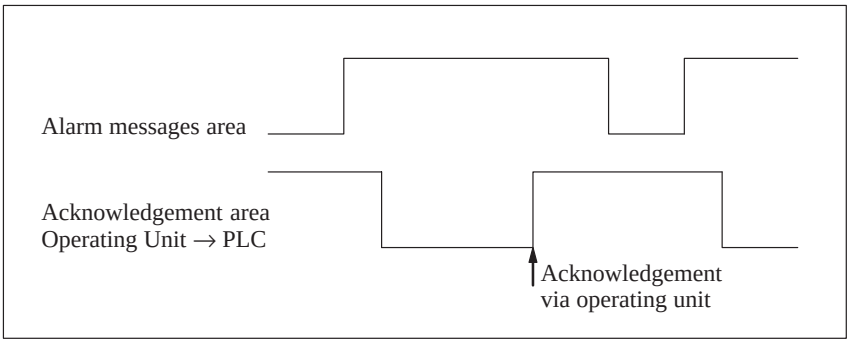


Figure 5-5 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area size

The acknowledgement areas PLC → Operating Unit and Operating Unit → PLC must not be any longer than the associated alarm message areas. They can, however, be smaller if acknowledgement by the PLC is not required for all alarm messages. This is also valid when the acknowledgement need not be detected in the PLC for all alarm messages. Figure 5-6 illustrates such a case.

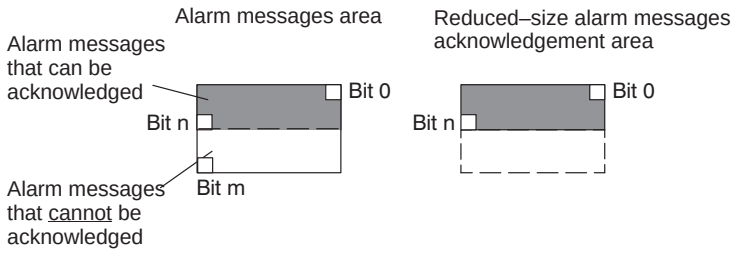


Figure 5-6 Reduced–size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 0 in ascending order.

5.3 LED Assignment

Application

The Operator Panel (OP) and Multi Panel (MP) have function keys with Light–Emitting Diodes (LEDs) integrated in them. These LEDs can be controlled from the PLC. This means, for example, that in specific situations, it is possible to indicate to the operator which key should be pressed by switching on an LED.

Condition

In order to control LEDs, corresponding data areas, so-called LED assignments, must be set up in the PLC and defined in the configuration as *area pointers*.

Data areas

The LED assignment can be divided into separate data areas, as illustrated in the following table.

Data areas	OP37/Pro	MP270
Max. number	8	8
Overall length of all data areas (words)	16	16

LED assignment

The assignment of the individual LEDs to the bits in the data areas is defined when the function keys are configured. This involves specifying a bit number within the assignment area for each LED.

The bit number (n) identifies the first of two consecutive bits that control a total of four different LED statuses (see Table 5-4):

Table 5-4 LED flashing frequency

Bit n + 1	Bit n	LED function
0	0	Off
0	1	Flashes
1	0	Flashes
1	1	Permanently on

5.4 Trend Request and Transfer Areas

Trends

A trend is a graphical representation of a value from the PLC. Reading of the value can be time-triggered or bit-triggered, depending on the configuration.

Time-triggered trends

The operating unit reads in the trend values cyclically, according to the time interval defined in the configuration. Time-triggered trends are suitable for continuous progressions such as the operating temperature of a motor.

Bit-triggered trends

By setting a trigger bit, the operating unit reads in either a trend value or the trend buffer. This is specified in the configuration. Bit-triggered trends are normally used to display values of an area subject to rapid variation. An example of this is the injection pressure for plastic mouldings.

In order to be able to activate bit-triggered trends, corresponding data areas have to be specified in the configuration (under *Area Pointers*) and set up on the PLC. The operating unit and the PLC communicate with one another via those areas.

The following areas are available for trends:
- Trend request area
- Trend transfer area 1
- Trend transfer area 2 (required with switch buffer only)

Assign a trend to a bit in the configuration. This ensures the bit assignment is unique for all areas.

Switch buffer

The switch buffer is a second buffer for the same trend and can be set up during the configuration.

While the operating unit reads the value from Buffer 1, the PLC writes it in Buffer 2. If the operating unit reads from Buffer 2, the PLC writes to Buffer 1. This prevents the trend value being overwritten by the PLC when being read by the operating unit.

Data area division

The individual areas, namely trend request area and trend transfer areas 1 and 2, can be divided into separate data areas with a predefined maximum number and length (Table 5-5).

Table 5-5 Division of data areas

	Data areas		
	Request	Transfer	
		1	2
Max. number per type	8	8	8
Overall length of all data areas (words)	8	8	8

Trend request area

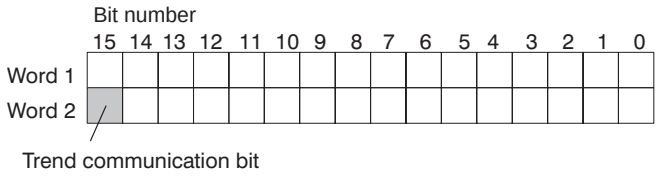
If a screen with one or more trends is opened on the operating unit, the operating unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

The trend request area can be used by the PLC to ascertain which trend is currently being displayed on the operating unit. Trends can also be triggered without analysis of the trend request area.

Trend transfer area 1

This area serves to trigger trends. In the PLC program, set the bit assigned to the trend in the trend transfer area and the trend communication bit. The operating unit detects triggering and reads in either a trend value or the entire buffer, according to the configuration. It then resets the trend bit and the trend communication bit.

Trend transfer area(s)



The trend transfer area must not be altered by the PLC program until the trend communication bit has been reset.

Trend transfer area 2

Trend transfer area 2 is necessary for trends that are configured with a switch buffer. Its layout is precisely the same as that of trend transfer area 1.

5.5 Screen Number Area

Application

The operating units store information concerning the screen currently open on the unit in the screen number area.

This enables the transfer of data regarding the current operating unit display content to the AG which, in turn, can trigger certain reactions; e.g. call in a different screen.

Condition

If the screen number area should be used, it must be specified in the configuration as an *Area Pointer*. It can only be stored in one AG and only once.

The screen number area is downloaded to the AG spontaneously, i.e. the transfer is always initiated when a change is registered on the operating unit. Therefore, it is not necessary to configure a polling time.

Structure

The screen number area is a data area with a fixed length of data words.

The structure of the screen number area in the PLC memory is illustrated below.

	15 … 0
Word 1	Current screen type
Word 2	Current screen number
Word 3	Reserved
Word 4	Reserved
Word 5	Reserved

Entry	Assignment
Current screen type	1
Current screen number	1 to 65535

5.6 Using PLC Jobs

Description

PLC jobs can be used to initiate functions on the operating unit from the PLC. These functions include:

- Displaying screens
- Setting date and time

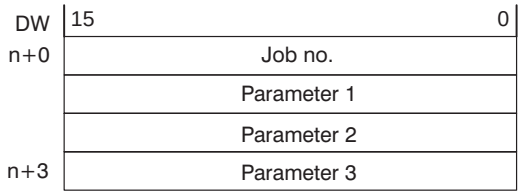
A PLC job is identified by its job number. Depending on the PLC job in question, up to three parameters can then be specified.

Job mailbox

The job mailbox can be used to send PLC jobs to the operating unit, thus initiating actions on the operating unit.

The job mailbox is set up under *Area Pointer* and has a length of four data words.

The first word of the job mailbox contains the job number. The parameters of the job must be entered in the succeeding words (maximum of 3).



If the first word of the job mailbox is not equal to zero, the operating unit analyzes the PLC job. The operating unit then sets this data word to zero again. For this reason, the parameters must be entered in the job mailbox first and then the job number.

The PLC jobs possible are listed in the Appendix B together with their job numbers and parameters.

5.7 Coordination Area

The coordination area is two data words long. It serves to realize the following functions:

- Detection of operating unit startup by the PLC program,
- Detection of the current operating unit operating mode by the PLC program,
- Detection by the PLC program that the operating unit is ready to communicate.

Note

Each time the coordination area is updated by the operating unit, the entire coordination area is written.

Therefore, the PLC program must not execute any modifications in the coordination area.

In order to use the coordination area, both data words must be specified, whereby the first data word is used. The second data word is reserved. Figure 5-7 illustrates the structure of the first data word.

Bit assignment in coordination area

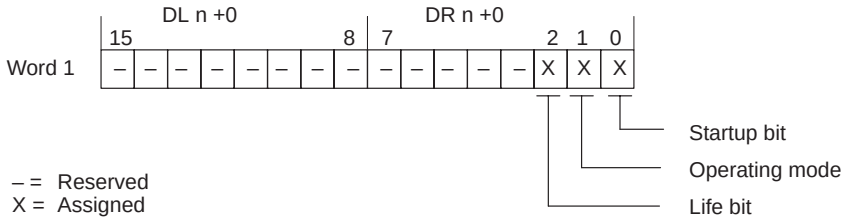


Figure 5-7 Significance of the bits in the coordination area

Startup bit

The startup bit is set to 0 for a short time during the start–up routine by the operating unit. After the startup routine has been completed, the bit is set permanently to 1.

Operating mode

As soon as the operating unit has been switched offline by the operator, the operating mode bit is set to 1. When the operating unit is working in normal operation, the operating mode bit is set to 0. The PLC program can be used to poll this bit and thus establish the current operating mode of the operating unit.

Life bit

The life bit is inverted by the operating unit at intervals of one second. The PLC program can be used to poll this bit to check whether connection to the operating unit still exists.

5.8 Transferring Date and Time to the PLC

Transferring date and time

Transfer of date and time from the operating unit to the PLC can be triggered by PLC job 41. PLC job 41 writes the date and time to the data area Date/ Time where they can be analyzed by the PLC program. Figure 5-8 illustrates the structure of the data area. All data is in BCD format.

	DL	DR	
DW	15 8	7 0	
n+0	Reserved	Hour (0...23)	Time
n+1	Minute (0...59)	Second (0 – 59)	
n+2	Reserved		
n+3	Reserved	Weekday (1...7, 1=Sun)	Date
n+4	Day (1...31)	Month (1 – 12)	
n+5	Year (0...99)	Reserved	

Figure 5-8 Structure of data area **Time** and **Date**

Part III Connection to SIMATIC S7

Communication Management for SIMATIC S7 6

User Data Areas for SIMATIC S7 7

Communication Management for SIMATIC S7

6

This chapter describes communication between the operating unit and SIMATIC S7. All the network configurations are explained in which the operating unit can be integrated.

General information

With the PLC system SIMATIC S7, operating units can be connected via different network configurations. The network configuration depends on the CPU being used. The following network configurations are possible:

PLC		Protocol profile
Adjustable in ProTool/Pro	**Modules**	
SIMATIC S7–300/400	CPU, Communication-compatible FM	MPI, DP[1], Standard[1], Universal[1]
SIMATIC S7–200	CPU	PPI[2], MPI[1], DP[1], Standard[1], Universal[1]

[1] CPU with PROFIBUS–DP interface only

[2] Not MP270

Supported operating units

The following operating units can be connected to the SIMATIC S7:

- PC
- OP37/Pro
- MP270

Installation

The driver for connecting to the SIMATIC S7 is supplied with the configuration software and installed automatically.

Connection of the operating unit to the SIMATIC S7 is basically restricted to the physical connection. Special function blocks for connection to the PLC are not required.

6.1 Basic Methods of Functioning

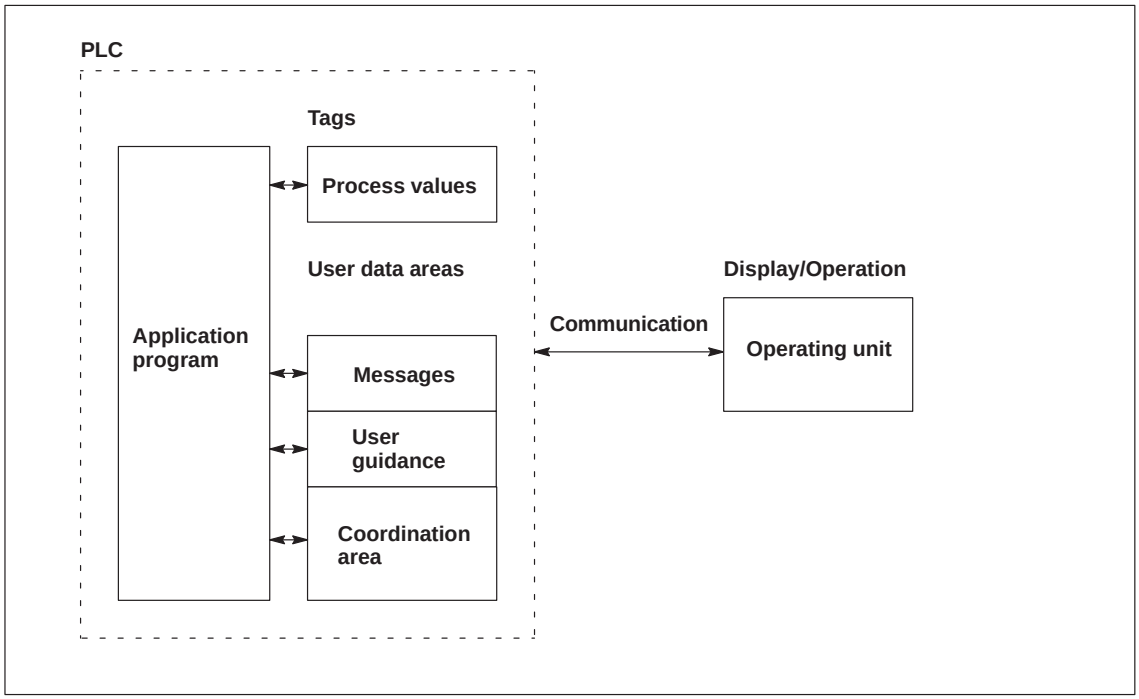


Figure 6-1 Communication structure

Task of the tags

The general exchange of data between SIMATIC S7 and operating unit is performed via the process values. To do this, tags must be specified in the configuration which point to an address in the S7. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit, which is then written to the address in the S7.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data areas are required for:
- Messages,
- Trends,
- PLC jobs,
- Controlling LEDs,
- Life bit monitoring.

A detailed description of the user data areas is provided in Chapter 7.

6.2 Configuring SIMATIC S7

Network configuration

The operating units communicate with the S7–300/400 via the S7 protocol. Connection can be established via the MPI or the PROFIBUS interface of the CPU. The simplest network configuration consists of one CPU and one operating unit. A more complex configuration might consist of a CPU and several operating units, for example. Figure 6-2 shows the various possible network configurations.

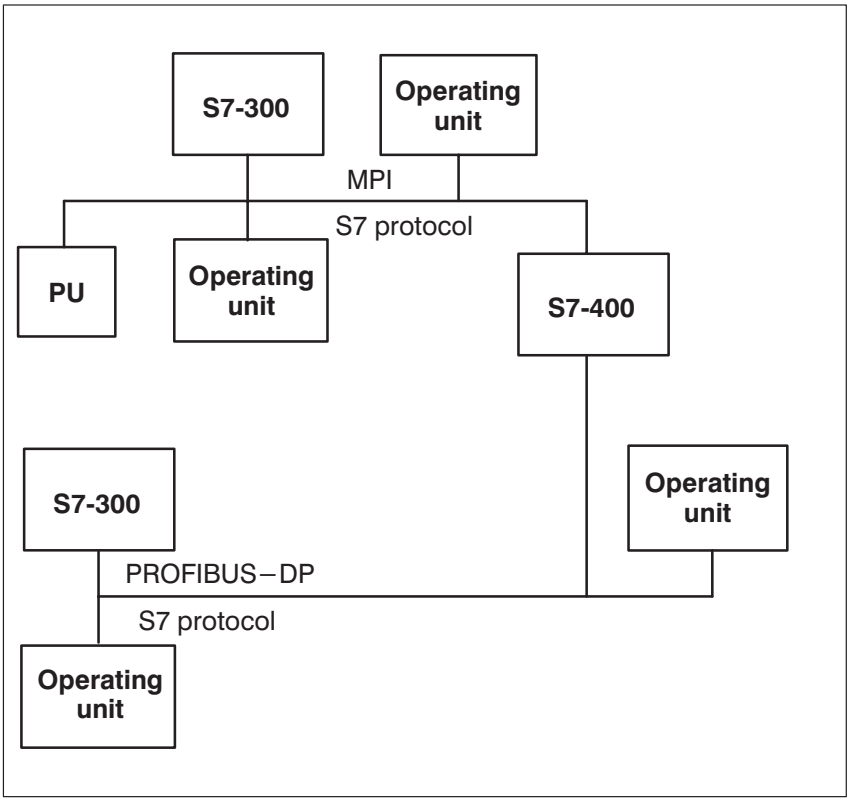


Figure 6-2 S7 network configurations

The following components are permissible in order to connect the OP37/Pro or PC to the SIMATIC S7:

SINEC L2 bus terminal RS485	Order no.: 6GK1500–0A_006
SINEC L2 bus connector (even)	Order no.: 6GK1500–0EA00
SINEC L2 bus connector (curved)[1)]	Order no.: 6ES7972–0B20–0XA0
SINEC L2 FO bus terminal	Order no.: 6GK1500–1A_00
Cable	Order no.: 6ES7901–0_ _ _0–0AA0

1) When using the curved bus connector, memory cards can no longer be removed or inserted.

'_' = Length code

For connection of a PC to the SIMATIC S7 requires the additional use of a Communication Processor (CP). The following table lists the permissible CPs.

Communication processor	Windows 95	Windows NT
CP5611	X	X
CP5411	X	X
CP5412	X	X
CP5511	X	–

Supported data types

When configuring tags and area pointers, the data types listed in Table 6-1 are available for use:

Table 6-1 Data types available

Data types supported for S7–300/400		
Data type	**Addressed by**	**Format**
Data block	DB	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING, TIMER, COUNTER
Memory	M	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING, TIMER, COUNTER
Input	E	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Peripheral input	PE	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Output	A	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Peripheral output	PA	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Timer	T	Timer
Counter	Z	Counter
Data types supported for S7–200		
Tag	V	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING

Table 6-1 Data types available, continued

Data types supported for S7–200		
Input	E	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Output	A	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Memory	M	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Timer	T	TIMER
Counter	Z	COUNTER

6.3 Connection to S7–200, S7-300 and S7-400 via MPI

Configuration

When connection is made via the MPI, the operating unit is connected to the MPI interface on the S7-300/400. Several operating units can be connected to an S7 and several S7 PLCs to an operating unit.

The SIMATIC S7–200 PLC should be configured in the network as a passive node. It is connected by means of the DP connector. The possible baud rate settings are 9.6 and 19.2 kBaud.

Figure 6-3 illustrates a possible network configuration. The numbers `1`, `2` etc. are examples of addresses. The addresses of the S7 nodes are assigned using STEP 7 hardware or network configuration.

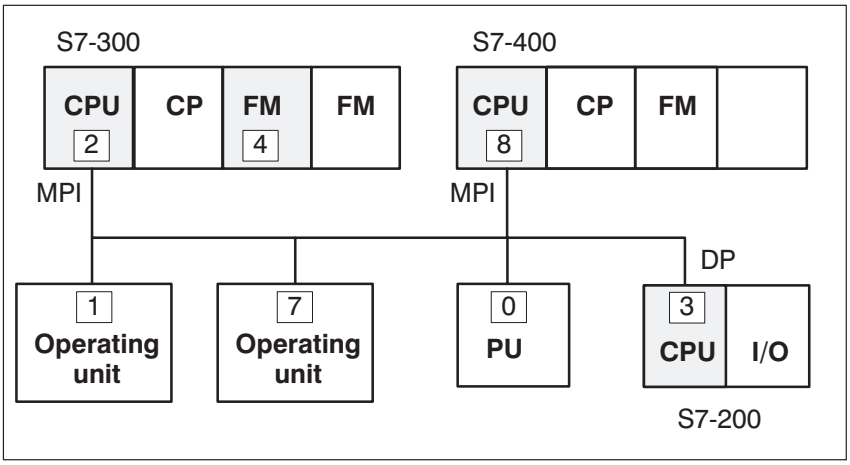


Figure 6-3 Connecting the operating unit to SIMATIC S7

Communication peer

Using the MPI connection, each communication-compatible module in the S7 is a communication peer for the operating unit. This involves:
– every CPU
– communication-compatible function modules (FMs), such as the FM356.

Modules that are communication-compatible are shown shaded in Figure 6-3.

Number of connectable operating units

With connection via an MPI, the operating unit is connected to the MPI interface of the S7–300/400. Several operating units can be connected to an S7 and several S7 PLCs to an operating unit. An operating unit can communicate with a maximum of 8 communication peers (e.g. CPUs or FMs) at the same time. In the case of S7–200, four communication peers are possible.

Similarly, a maximum number of connections to operating units is defined for each communication–compatible module. For example, three operating units can be connected simultaneously to a CPU314 and thirty–one to a CPU414–1. For details of the maximum number of connections that a module may have at a time, refer to the documentation for the module concerned.

Configure the operating unit

In order that the operating unit can communicate and exchange data with a CPU or an FM, it must be correctly configured. To do this, define the address of the operating unit in the ProTool/Pro configuration and specify the parameters for the connections with the communication peers.

When creating a new project, the project assistant requests the definition of the PLC. First of all, select the driver `SIMATIC S7 200` or `SIMATIC S7 300/400` and then define the following parameters in the box which appears after clicking button *Parameter.* For any subsequent parameter modifications, select the item *PLC* in the project window.

Parameters

The parameters are divided into three groups.

- Use *OP Parameters* to enter the parameters for the operating unit in the network configuration. This is done only once. Any alteration to the operating unit parameters applies to all communication peers.
- Use *Network Parameters* to enter the parameters for the network to which the operating unit is linked. By clicking the *More* button, it is possible to set the HSA and the number of masters in the network.

  After having installed “STEP 7 integrated” in ProTool/Pro and connected the operating unit to the network, the network parameters are assumed. Click the *More* button to display the global network parameters.
- Use *Peer Parameters* to enter the address details of the S7 module with which the operating unit is to exchange data. A symbolic name has to be defined for each communication peer.

The individual parameters are explained in Table 6-2.

Table 6-2 Configuration parameters

Group	Parameter	Explanation
Operating unit parameters	Address	MPI address of the operating unit
	Interface	Interface on the operating unit via which the operating unit is connected to the PPI network.
Network parameters	Profile	The protocol profile used in the network configuration. Enter *MPI* here.
	Baud rate	The baud rate at which communication takes place over the network.
Peer parameters	Address	MPI address of the S7 module (CPU, FM or CP) to which the operating unit is connected.
	Slot	Number of the slot containing the S7 module with which the operating unit exchanges data.
	Rack	Number of the rack containing the S7 module with which the operating unit exchanges data.
	Cyclical operation	If cyclical operation is activated, the PLC optimizes data transfer between the operating unit and PLC. This achieves a better performance. **Limitations:** Where several operating units are running in parallel operation, cyclical operation should be deactivated.
More button	HSA	Highest Station Address; this must be identical throughout the whole network configuration.
	Master	Number of masters in the network. This information is only required for PROFIBUS networks and is necessary in order that the bus parameters can be calculated correctly.

6.3.1 Addressing S7–300 using the MPI

MPI address

Each communication–compatible module in the S7–300 has a unique MPI address which may only be assigned once within the network configuration. Only one CPU may be used in each rack. Figure 6-4 illustrates direct connection of the operating unit to the MPI interface of the CPU.

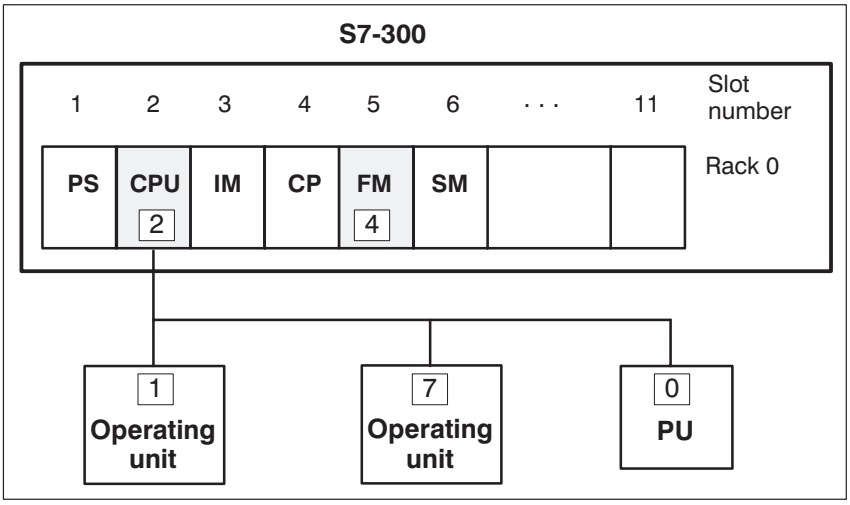


Figure 6-4 Network configuration with S7–300 and operating unit – one rack

Peer address

With regard to the addressing, it is important to differentiate between peers with an *own MPI address* and peers *without an own MPI address*.

- In the case of peers with their own MPI address, only the MPI address need be specified. Slot and rack details are not relevant.
- In the case of peers without their own MPI address, the MPI address of the peer via which communication is to be performed must be specified. In addition, the slot number and the rack number of peers without MPI addresses must be specified.

Example: CPU address

In order that the operating unit can communicate with the CPU illustrated in Figure 6-4, the following parameters must be specified for the *communication peer* S7–CPU:

Example based on Figure 6-4		
	Own MPI address	**No own MPI address**
Address	2	2
Slot number	0	2
Rack	0	0

The above values are also specified as the default values in ProTool/Pro.

FM address

The operating unit can only communicate with FM modules which have an MPI address. That covers all FMs that are connected to the K bus.

FMs that do not have an MPI address are connected to the P bus. These include the FM350s, for example. The data from these FMs can be visualized on the operating unit by means of the I/O pattern of the CPU.

Example based on Figure 6-4		
	Own MPI Address	**No Own MPI Address**
Address	4	2
Slot number	0	5
Rack	0	0

Number of racks

An S7–300 can be comprised of a maximum of four racks. The operating unit can communicate with any communication–compatible module in those racks. Figure 6-5 illustrates a configuration involving multiple racks and the allocation of addresses.

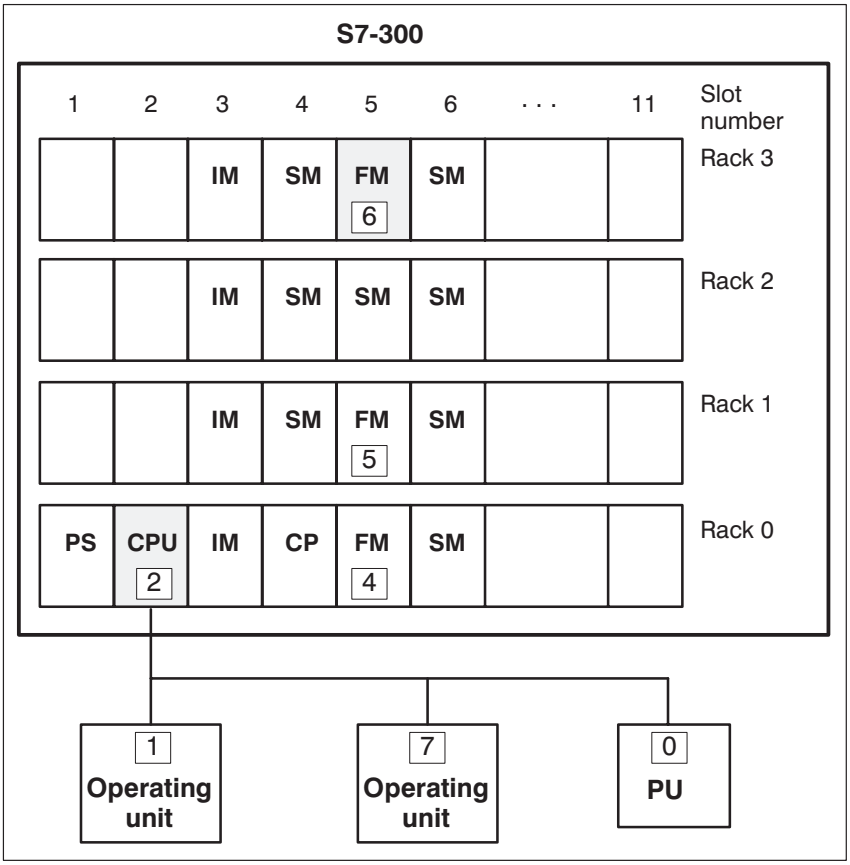


Figure 6-5 Network configuration with S7–300 and operating units – four racks

Example: FM address

In order that the operating unit can communicate with the shaded FM shown in Figure 6-5, the following parameters must be specified for the *communication peer*:

Example based on Figure 6-5		
	Own MPI address	**No own MPI address**
Address	6	2
Slot number	0	5
Rack	0	3

6.3.2 Addressing the S7–400 using the MPI

MPI address

Only modules which have an MPI connector have such an MPI address. The MPI address must be unique within the network configuration. Modules that do not have an MPI connector are addressed indirectly by means of
– the MPI address of the module to which the operating unit is connected,
– the slot and rack in which the module is installed,
– to the operating unit with which it should communicate.

Figure 6-6 illustrates a simple network configuration with one rack.

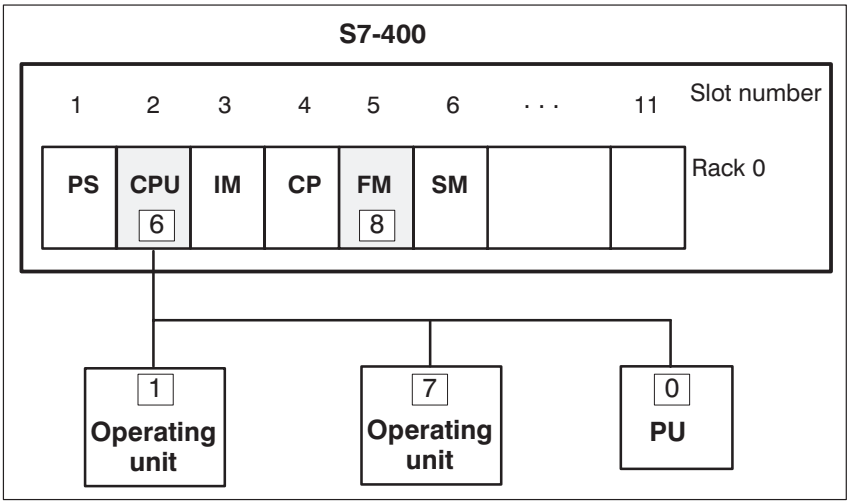


Figure 6-6 Network configuration with S7–400 and operating unit – one rack

Example: CPU address

In order that the operating unit can communicate with the shaded CPU shown in Figure 6-6, the following parameters must be specified for the *communication peer*:

Example based on Figure 6-6		
	Own MPI address	**No own MPI address**
Address	6	6
Slot number	0	2
Rack	0	0

Example: FM address

In order that the operating unit can communicate with the shaded FM shown in Figure 6-6, the following parameters must be specified for the *communication peer*:

Example based on Figure 6-6		
	Own MPI address	**No own MPI address**
Address	8	6
Slot number	0	5
Rack	0	0

Operating unit to FM

The operating unit can only communicate with FM modules connected to the K bus. These include the FM453, for example.

6.4 Connection to S7-200, S7-300 and S7-400 via PROFIBUS

Configuration

Within a PROFIBUS network, an operating unit can be connected to all S7 modules that have an integrated PROFIBUS or PROFIBUS–DP interface and support the S7 driver. Several operating units can be connected to an S7 and several S7 PLCs to an operating unit.

Figure 6-7 illustrates one possible network configuration. The numbers 1, 2, etc. are examples of addresses. The addresses of the S7 nodes are assigned using STEP 7 hardware or network configuration.

The PLC SIMATIC S7-200 should be configured as a passive node in the network configuration. The S7-200 is connected via the DP connector.

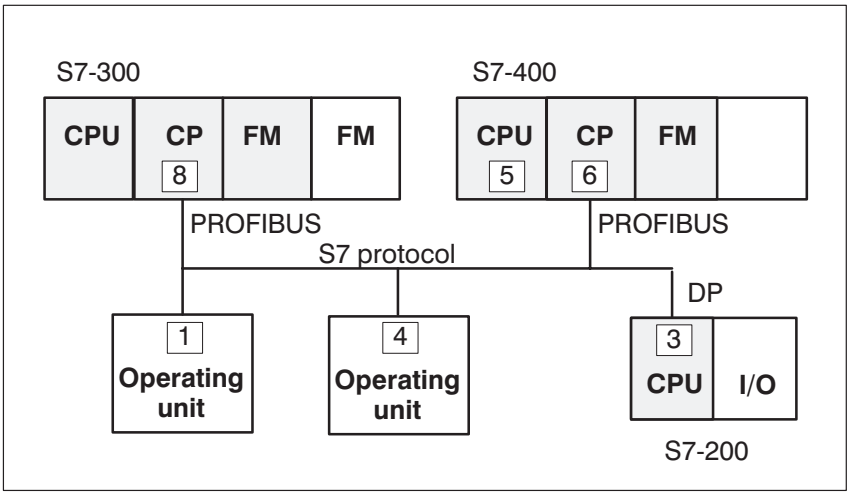


Figure 6-7 Connecting the operating unit to the SIMATIC S7 via PROFIBUS

Communication peer

As in the case of the MPI interface, the operating unit can exchange data with any communication–compatible S7 module via PROFIBUS and PROFIBUS–DP. This involves:

- any CPU that supports the S7 driver,
  such as CPU 413–2DP, CPU 414–2DP,
  CPU 315–2DP, version 315–2AF01–0AB0 or later
- communication-compatible function modules (FMs)
- communication processors (CPs), such as the CP342–5DP.

The modules with which the operating unit can communicate are illustrated, shaded, in Figure 6-7.

Configure the operating unit

In order that the operating unit can communicate and exchange data with a CPU or an FM, it must be correctly configured. To do this, define the address of the operating unit in the ProTool/Pro configuration and specify the parameters for the connections with the communication peers.

When creating a new project, the project assistant requests the definition of the PLC. First of all, select the protocol *SIMATIC S7 300/400* and then define the following parameters after clicking on the button *Parameter.* For any subsequent parameter modifications, select the item *PLC* in the project window.

Parameters

The parameters are divided into three groups.

- Use *OP Parameters* to enter the parameters for the operating unit in the network configuration. This is done only once. Any alteration to the operating unit parameters applies to all communication peers.
- Use *Network Parameters* to enter the parameters for the network to which the operating unit is linked. By clicking the *More* button, it is possible to set the HSA and the number of masters in the network.

  After having installed “STEP 7 integrated” in ProTool/Pro and connected the operating unit to the network, the network parameters are assumed. Click the *More* button to display the global network parameters.
- Use *Peer Parameters* to enter the address details of the S7 module with which the operating unit is to exchange data. A symbolic name has to be defined for each communication peer.

The individual parameters are explained in Table 6-3.

Table 6-3 Configuration parameters

Group	Parameter	Explanation
Operating unit parameters	Address	PROFIBUS address of the operating unit.
	Interface	Interface on the operating unit via which the unit is connected to the PROFIBUS network.
Network parameters	Profile	The protocol profile used in the network configuration. Enter *DP*, *Standard* or *Universal* here. This setting must be identical throughout the whole network configuration.
	Baud rate	The baud rate at which communication takes place over the network.

Table 6-3 Configuration parameters, continued

Group	Parameter	Explanation
Peer parameters	Address	PROFIBUS address of the S7 module (CPU, FM or CP) to which the operating unit is connected.
	Slot	Number of the slot containing the S7 module with which the operating unit exchanges data.
	Rack	Number of the rack containing the S7 module with which the operating unit exchanges data.
	Cyclical operation	If cyclical operation is activated, the PLC optimizes data transfer between the operating unit and PLC. This achieves a better performance. **Limitations:** Where several operating units are running in parallel operation, cyclical operation should be deactivated.
More button	HSA	Highest Station Address; this must be identical throughout the whole network configuration.
	Master	Number of masters in the network. This information is only required for PROFIBUS networks and is necessary in order that the bus parameters can be calculated correctly.

Addressing using S7–300

A communication–compatible S7 module is addressed by means of the following parameters:

Address: *PROFIBUS address of the CP.*
Slot: *Slot number of the S7 module*
Rack: *Rack in which the S7 module is located*

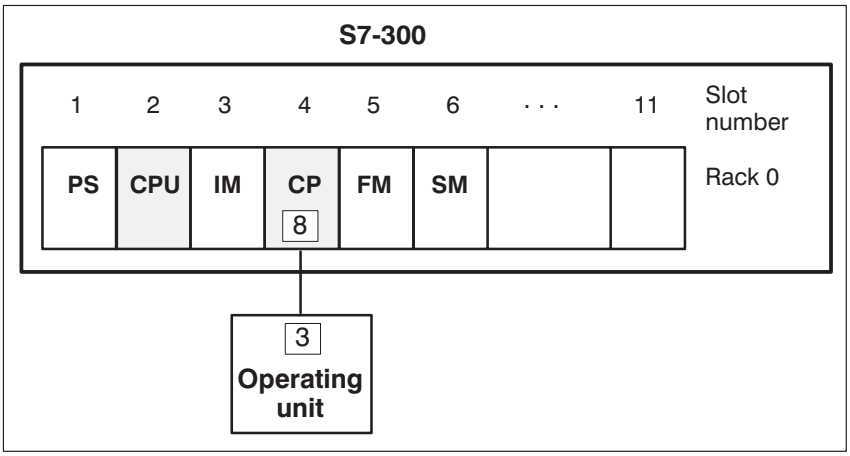


Figure 6-8 Network configuration with S7–300 and operating unit, PROFIBUS–DP profile

The CPU illustrated in Figure 6-8 is addressed as follows:

Address: 8
Slot: 2
Rack: 0

Addressing using S7–400

A communication–compatible S7 module is addressed by means of the following parameters:

Address: *PROFIBUS address of the CP or the DP interface of the CPU*
Slot: *Slot number of the S7 module*
Rack: *Rack in which the S7 module is located*

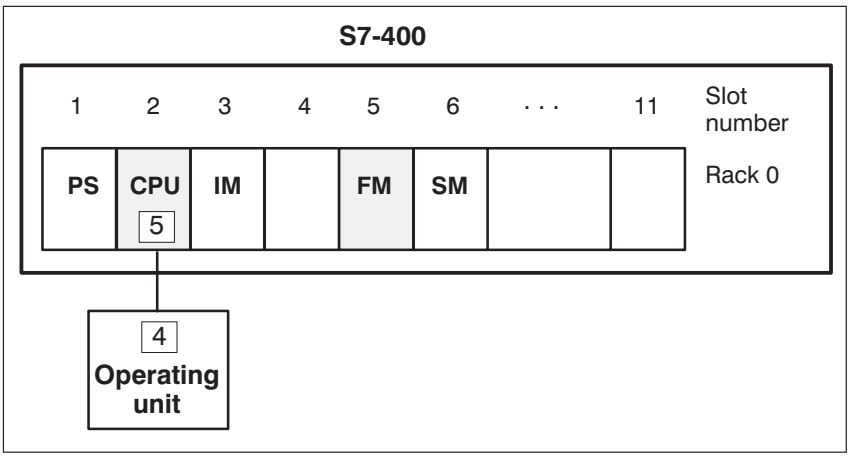


Figure 6-9 Network configuration with S7–400 and operating unit – PROFIBUS–DP profile

The CPU illustrated in Figure 6-9 is addressed as follows:
Address: 5
Slot: 2
Rack: 0

The FM is addressed as follows:
Address: 5
Slot: 5
Rack: 0

6.5 Connection to S7-200 via the PPI

Concept

The PPI concerns a point-to-point connection in which the operating unit is the master and the S7–200 the slave.

Configuration

In the case of connection to S7–200, the operating unit is connected to the PPI interface of the S7–200. The operating unit is connected via the serial connector of the CPU. Figure 6-10 illustrates one possible network configuration. The numbers 1, 2 and 3 are examples of addresses.

A maximum of one S7–200 can be connected to an operating unit. However, several operating units can be connected to one S7–200. In such cases, as far as the S7–200 is concerned, only one link is possible at any one time.

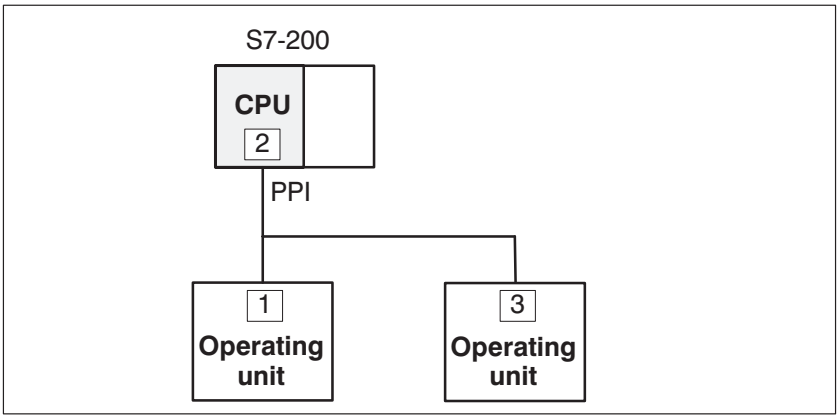


Figure 6-10 Connecting the operating unit to the SIMATIC S7–200

Configure the operating unit

In order that the operating unit can communicate and exchange data via a CPU, the operating unit must be correctly configured. To do this, define the address of the operating unit in the ProTool/Pro configuration and specify the parameters for the connections with the communication peers.

When creating a new project, the project assistant requests the definition of the PLC. First of all, select the protocol *SIMATIC S7 200* and then specify the following parameters after clicking on the button *Parameter.* For any subsequent parameter modifications, select the item *PLC* in the project window.

Parameters

The parameters are divided into three groups.

- Use *OP Parameters* to enter the parameters for the operating unit in the network configuration. This is done only once. Any alteration to the operating unit parameters applies to all communication peers.
- Use *Network Parameters* to enter the parameters for the network to which the operating unit is linked. By clicking the *More* button, it is possible to set the HSA and the number of masters in the network.
- Use *Peer Parameters* to enter the address details of the S7 module with which the operating unit is to exchange data. A symbolic name has to be defined for each communication peer.

The individual parameters are explained below in Table 6-4.

Table 6-4 Configuration parameters

Group	Parameter	Explanation
Operating unit parameters	Address	Operating unit PPI address
	Interface	Interface on the operating unit via which the unit is connected to the PPI network.
Network parameters	Profile	The protocol profile used in the network configuration. Enter *PPI* here.
	Baud rate	The baud rate (9600 or 19200 Baud) at which communication takes place across the network.
Peer parameters	Address	PPI address of the S7 module to which the operating unit is connected.
More button	HSA	Highest Station Address; this must be identical throughout the whole network configuration.
	Master	Number of masters in the network. This information is only required for PROFIBUS networks and is necessary in order that the bus parameters can be calculated correctly.

6.6 Optimization

Acquisition cycle and update time

The acquisition cycles defined in the configuration software for the *area pointers* and for the tags are major factors in respect of the real update times which are achieved. The update time is the acquisition cycle plus transmission time plus processing time.

In order to achieve optimum update times, the following points should be observed during configuration:

- When setting up the individual data areas, make them as large as necessary but as small as possible.
- Define data areas that belong together as contiguous areas. The real update time is improved by setting up one large are area instead of several small areas.
- Setting acquisition cycles which are too short unnecessarily impairs overall performance. Set the acquisition cycle to correspond to the modification time of the process values. The rate of change of temperature of a furnace, for example, is considerably slower than the acceleration curve of an electric motor.

  Guideline value for the acquisition cycle: Approx. 1 second.
- If necessary, dispense with cyclic transmission of user data areas (acquisition cycle = 0) in order to improve the update time. Instead, use PLC jobs to transfer the user data areas at random times.
- Store the tags for a message or a screen in a contiguous data area.
- In order that changes on the PLC are reliably detected by the operating unit, they must occur during the actual acquisition cycle at least.

Screens

In the case of screens, the real update time which can be achieved is dependent on:

- the number of data areas used,
- the type and volume of data to be displayed,
- the distribution of data within a particular data area.

In the interests of achieving rapid update times, the following points should be observed during configuration:

- Use only one data block for the tags of a particular screen.
- Store the items of data to be used as closely as possible to one another in the DB.
- only configure short acquisition cycles for those objects which actually need to be updated quickly.

Trends

If, in the case of bit-triggered trends, the communication bit is set in the *trend transfer area*, the operating unit always updates all the trends whose bit is set in that area. It resets the bit afterwards. If the S7 program immediately sets the bit again, the operating unit spends all its time updating the trends. It is then virtually impossible to operate the operating unit.

PLC jobs

If large numbers of PLC jobs are sent to the operating unit in quick succession, communication between the operating unit and PLC may become overloaded as a result.

If the operating unit enters the value 0 in the first data word of the job mailbox, it signifies that the operating unit has accepted the job. It then processes the job, for which it requires a certain amount of time. If a new PLC job is then immediately entered in the job mailbox, it may take some time before the operating unit executes the next PLC job. The next PLC job is only accepted when sufficient computer performance is available.

User Data Areas for SIMATIC S7

7

User data areas are used for data exchange between the PLC and operating unit.

These data areas are written to and read by the operating unit and the application program alternately during the process of communication. By analyzing the data stored there, the PLC and operating unit reciprocally initiate predefined actions.

This chapter describes the function, layout and special features of the various user data areas.

7.1 Overview

Definition

User data areas can be located in data blocks and memory areas in the PLC. User data areas include messages and trends. Set up user data areas both in the configuration, using menu item *System* → *Area Pointer* and in the PLC.

Function range

The user data areas available is dependent on the operating unit used. Table 7-1 summarizes the range of functions available on the individual operating units.

Table 7-1 Applicable user data areas

User data area	PC	MP270	OP37/Pro
Event messages	X	X	X
Alarm messages	X	X	X
Aknowledgement area	X	X	X
LED assignment	–	X	X
Trend request area	X	X	X
Trend transfer areas	X	X	X
Screen number	X	X	X
PLC jobs	X	X	X
Coordination area	X	X	X
Date and time	X	X	X

Table 7-2 indicates who is reading (**R**) and who is writing (**W**) in respect of access to the individual data areas.

Table 7-2 Use of data areas

Data area	Necessary for	Operating unit	PLC
Event messages	Configured event messages	R	W
Alarm messages	Configured alarm messages	R	W
PLC acknowledgement	Alarm message acknowledgement from the PLC	R	W
Operating unit acknowledgement	Message from the operating unit to the PLC indicating an alarm message has been acknowledged	W	R
LED assignment (for OP and MP only)	LED triggered by the PLC	R	W

Table 7-2 Use of data areas, continued

Data area	Necessary for	Operating unit	PLC
Trend request	Configured trends with “Triggering via bit” or configured history trends	W	R
Trend transfer 1	Configured trends with “Triggering via bit” or configured history trends	R/W	R/W
Trend transfer area 2	Configured history trend with “switch buffer”	R/W	R/W
Screen number	Evaluation by the PLC as to which screen is currently open	W	R
PLC jobs	Triggering of functions on the operating unit by PLC program	R/W	R/W
Coordination area	Operating unit status polled by the PLC program	W	R
Date and time	Transfer of date and time from the operating unit to the PLC	W	R

7.2 Event and Alarm Messages

Definition

Messages consist of a static text and/or tags. The text and tags can be defined by the user.

Messages are subdivided into event messages and alarm messages. The programmer defines the event message and alarm message.

Event message

An event message indicates a status, e.g.

- `Motor switched on`
- `PLC in manual mode`

Alarm message

An alarm message indicates an operational fault, e.g.

- `Valve not opening`
- `Motor temperature too high`

Acknowledgement

Since alarm messages indicate an abnormal operational status, they must be acknowledged. They can be acknowledged either by

- operator input on the operating unit,
- setting a bit in the PLC acknowledgement area.

Triggering messages

A message is triggered by setting a bit in one of the message areas on the PLC. The location of the message areas is defined by means of the configuration software. The corresponding area must also be set up in the PLC.

As soon as the bit in the PLC event/alarm message area has been set and that area has been transferred to the operating unit, the operating unit detects that the relevant message has “arrived”.

Conversely, when the same bit is reset on the PLC by the operating unit, the message is registered as having “departed”.

Message areas

Table 7-3 indicates the number of message areas for event and alarm messages, the number of alarm message acknowledgement areas (PLC → Operating Unit and Operating Unit → PLC) and the total length of the respective areas for the various operating units.

Table 7-3 Operating unit message areas

Unit	**Event message area**		**Alarm messages area/ Alarm message acknowledgement area**	
	Number	**Length** (words)	**Number per type**	**Overall length per type** (words)
PC	8	125	8	125
OP37/Pro	8	125	8	125
MP270	8	125	8	125

Assignment of message bit and message number

A message can be configured for each bit in the message area configured. The bits are assigned to the message numbers in ascending order.

Example:

Assume that the following event message area has been configured for the SIMATIC S7 PLC:

`DB 60 Address 42 Length 5` (in words)

Figure 7-1 illustrates the assignment of all 80 (5 x 16) message numbers to the individual bit numbers in the PLC event message area.

The assignment is performed automatically on the operating unit.

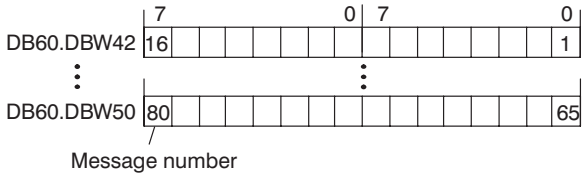


Figure 7-1 Assignment of message bit and message number

Acknowledgement areas

If the PLC should be informed of an alarm message acknowledgement on the operating unit or the acknowledgement should be initiated on the PLC itself, the relevant acknowledgement areas must also be set up in the PLC. These acknowledgement areas must also be specified in the configuration.

- **Acknowledgement area Operating Unit → PLC**:
  This area is used to inform the PLC when an alarm message has been acknowledged by means of operator input on the operating unit. In this case, the area pointer “OP acknowledgement” must be set.
- **Acknowledgement area PLC → Operating Unit**:
  This area is used when an alarm message is acknowledged by the PLC. In this case, the area pointer “PLC acknowledgement” must be set.

These acknowledgement areas must also be specified in the configuration under *Area Pointers*.

Figure 7-2 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 7-4 and 7-5.

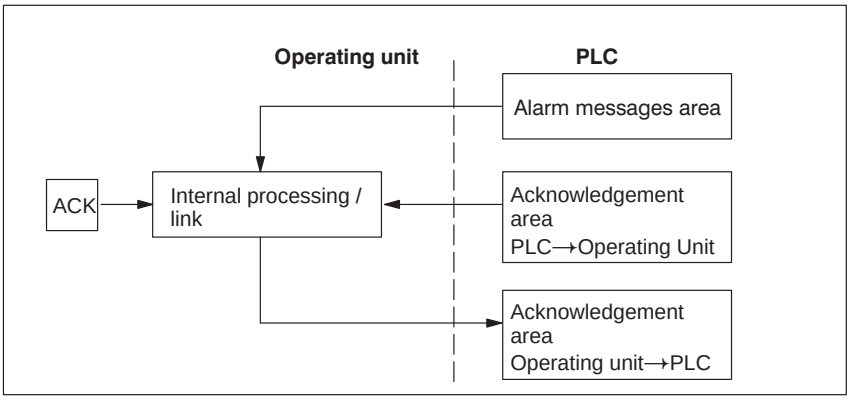


Figure 7-2 Alarm message and acknowledgement areas

Assignment of acknowledgement bit to message number

Each alarm message is assigned a message number. The message number is assigned the same bit number in the alarm messages area as that assigned in the acknowledgement area. Under normal circumstances, the acknowledgement area is the same length as the associated alarm messages area.

If the length of an acknowledgement area is not equal to the overall length of the associated alarm messages area, and there are succeeding alarm messages and acknowledgement areas, the following assignment applies:

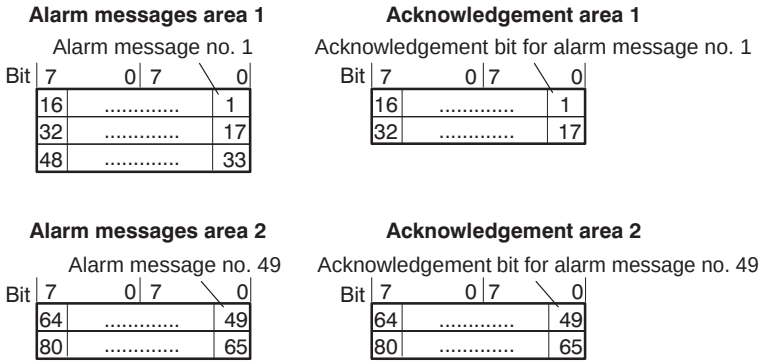

Alarm messages area 1
Alarm message no. 1
Bit 7 0 7 0
16 1
32 17
48 33
Acknowledgement area 1
Acknowledgement bit for alarm message no. 1
Bit 7 0 7 0
16 1
32 17
Alarm messages area 2
Alarm message no. 49
Bit 7 0 7 0
64 49
80 65
Acknowledgement area 2
Acknowledgement bit for alarm message no. 49
Bit 7 0 7 0
64 49
80 65

Figure 7-3 Assignment of acknowledgement bit and message number

Acknowledgement area PLC → Operating Unit

A bit set in this area by the PLC initiates the acknowledgement of the corresponding alarm message in the operating unit, thus fulfilling the same function as pressing the “ACK” key. Reset the bit before setting the bit in the alarm message area again. Figure 7-4 shows the signal diagram.

The acknowledgement area PLC→ Operating Unit

- must follow on immediately from the associated alarm messages area,
- must have precisely the same polling time and
- may not be any longer than the associated alarm messages area.

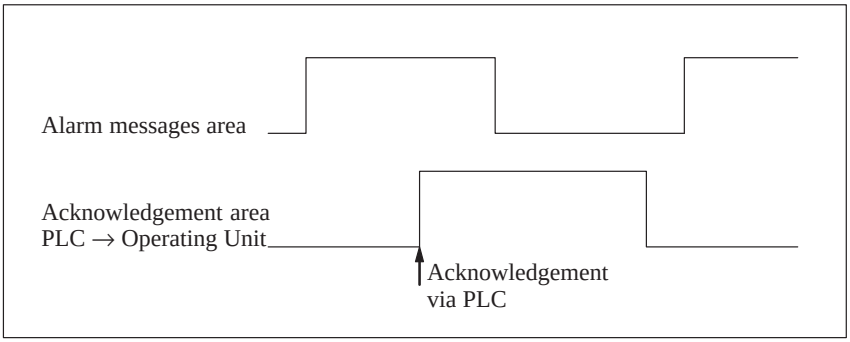


Figure 7-4 Signal diagram for acknowledgement area PLC → Operating Unit

Acknowledgement area Operating Unit → PLC

When a bit is set in the alarm message area, the operating unit resets the associated bit in the acknowledgement area. As a result of processing via the operating unit, the two processes indicate a slight difference with regard to time. If the alarm message is acknowledged on the operating unit, the bit in the acknowledgement area is set. In this way, the PLC can detect that the alarm message has been acknowledged. Figure 7-5 illustrates the signal diagram.

The acknowledgement area Operating Unit → PLC must be no longer than the associated alarm messages area.

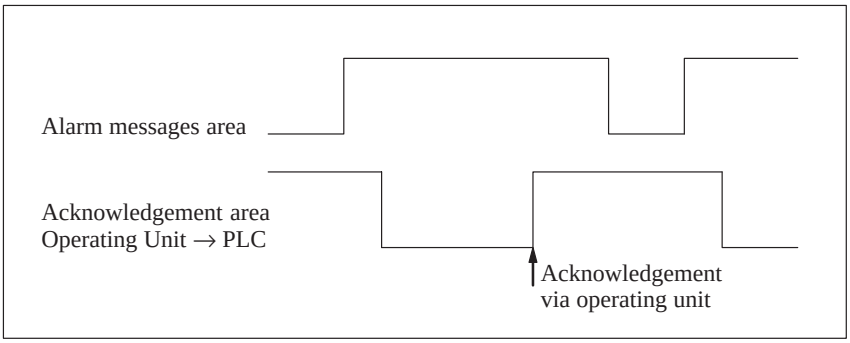


Figure 7-5 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area size

The acknowledgement areas PLC → Operating Unit and Operating Unit → PLC must not be any longer than the associated alarm message areas. They can, however, be smaller if acknowledgement by the PLC is not required for all alarm messages. This is also valid when the acknowledgement need not be detected in the PLC for all alarm messages. Figure 7-6 illustrates such a case.

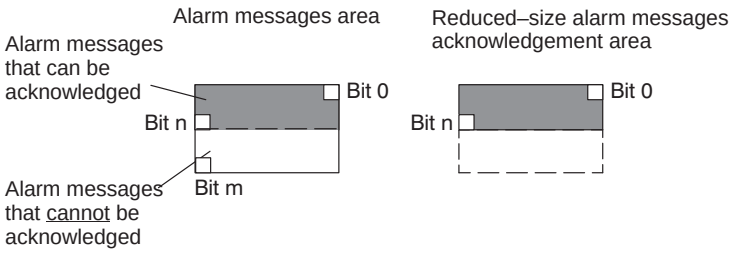


Figure 7-6 Reduced–size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 0 in ascending order.

7.3 LED Assignment

Application

The Operator Panel (OP) and Multi Panel (MP) have function keys with Light–Emitting Diodes (LEDs) integrated in them. These LEDs can be controlled from the PLC. This means, for example, that in specific situations, it is possible to indicate to the operator which key should be pressed by switching on an LED.

Condition

In order to control LEDs, corresponding data areas, so-called LED assignments, must be set up in the PLC and defined in the configuration as *area pointers*.

Data areas

The LED assignment can be divided into separate data areas, as illustrated in the following table.

Data areas	OP37/Pro	MP270
Max. number	8	8
Overall length of all data areas (words)	16	16

LED assignment

The assignment of the individual LEDs to the bits in the data areas is defined when the function keys are configured. This involves specifying a bit number within the assignment area for each LED.

The bit number (n) identifies the first of two consecutive bits that control a total of four different LED statuses (see Table 7-4):

Table 7-4 LED flashing frequency

Bit n + 1	Bit n	LED function
0	0	Off
0	1	Flashes
1	0	Flashes
1	1	Permanently on

7.4 Trend Request and Transfer Areas

Trends

A trend is the graphical representation of a value from the PLC. Reading of the value can be time-triggered or bit-triggered, depending on the configuration.

Time-triggered trends

The operating unit reads in the trend values cyclically, according to the time interval defined in the configuration. Time-triggered trends are suitable for continuous progressions such as the operating temperature of a motor.

Bit-triggered trends

By setting a trigger bit, the operating unit reads in either a trend value or the entire trend buffer. This is specified in the configuration. Bit-triggered trends are normally used to display values of an area subject to rapid variation. An example of this is the injection pressure for plastic mouldings.

In order to be able to activate bit-triggered trends, corresponding data areas have to be specified in the configuration (under *Area Pointers*) and set up on the PLC. The operating unit and the PLC communicate with one another via those areas.

The following areas are available for trends:
- Trend request area
- Trend transfer area 1
- Trend transfer area 2 (required with switch buffer only)

Assign a trend to a bit in the configuration. This ensures the bit assignment is unique for all areas.

Switch buffer

The switch buffer is a second buffer for the same trend and can be set up during the configuration.

While the operating unit reads the value from Buffer 1, the PLC writes it in Buffer 2. If the operating unit reads from Buffer 2, the PLC writes to Buffer 1. This prevents the trend value being overwritten by the PLC when being read by the operating unit.

Data area division

The individual areas, namely trend request area and trend transfer areas 1 and 2, can be divided into separate data areas with a predefined maximum number and length (Table 7-5).

Table 7-5 Division of data areas

	Data areas		
	Request	Transfer	
		1	2
Max. number per type	8	8	8
Overall length of all data areas (words)	8	8	8

Trend request area

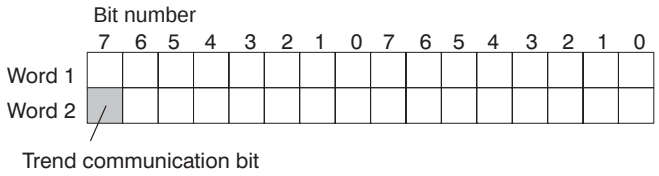
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

The trend request area can be used by the PLC to ascertain which trend is currently being displayed on the operating unit. Trends can also be triggered without analysis of the trend request area.

Trend transfer area 1

This area serves to trigger trends. In the PLC program, set the bit assigned to the trend in the trend transfer area and the trend communication bit. The operating unit detects triggering and reads in either a trend value or the entire buffer, according to the configuration. It then resets resets the trend bit and the trend communication bit .

Trend transfer area(s)



The trend transfer area must not be altered by the PLC program until the trend communication bit has been reset.

Trend transfer area 2

Trend transfer area 2 is necessary for trends that are configured with a switch buffer. Its layout is precisely the same as that of trend transfer area 1.

7.5 Screen Number Area

Application

The operating units store information concerning the screen currently open on the unit in the screen number area.

This enables the transfer of data regarding the current operating unit display content to the PLC which, in turn, can trigger certain reactions; e.g. call in a different screen.

Condition

If the screen number area should be used, it must be specified in the configuration as an *Area Pointer*. It can only be stored in one PLC and only once.

The screen number area is downloaded to the PLC spontaneously, i.e. the transfer is always initiated when a change is registered on the operating unit. Therefore, it is not necessary to configure a polling time.

Structure

The screen number area is a data area with a fixed length of data words.

The structure of the screen number area in the PLC memory is illustrated below.

	15	0
Word 1	Current screen type	
Word 2	Current screen number	
Word 3	Reserved	
Word 4	Reserved	
Word 5	Reserved	

Entry	Assignment
Current screen type	1
Current screen number	1 to 65535

7.6 Using PLC Jobs

Description

PLC jobs can be used to initiate functions on the operating unit from the PLC. These functions include:

- Displaying screens
- Setting date and time

A PLC job is identified by its job number. Depending on the PLC job in question, up to three parameters can then be specified.

Job mailbox

The job mailbox can be used to send PLC jobs to the operating unit, thus initiating actions on the operating unit.

The job mailbox is set up under *Area Pointer* and has a length of four data words.

The first word of the job mailbox contains the job number. The parameters of the job must be entered in the succeeding words (maximum of 3).

Word	Left byte (LB)	Right byte (RB)
n+0	0	Job no.
n+2	Parameter 1	
n+4	Parameter 2	
n+6	Parameter 3	

Figure 7-7 Structure of the job mailbox data area

If the first word of the job mailbox is not equal to zero, the operating unit analyzes the PLC job. The operating unit then sets this data word to zero again. For this reason, the parameters must be entered in the job mailbox first and then the job number.

The PLC jobs possible are listed in the Appendix B together with their job numbers and parameters.

7.7 Coordination Area

The coordination area is two data words long. It serves to realize the following functions:

- Detection of operating unit startup by the PLC program,
- Detection of the current operating unit operating mode by the PLC program,
- Detection by the PLC program that the operating unit is ready to communicate.

Note

Each time the coordination area is updated by the operating unit, the entire coordination area is written.

Therefore, the PLC program must not execute any modifications in the coordination area.

In order to use the coordination area, both data words must be specified, whereby the first data word is used. The second data word is reserved. Figure 7-8 illustrates the structure of Byte 1 in the first data word.

Bit assignment in coordination area

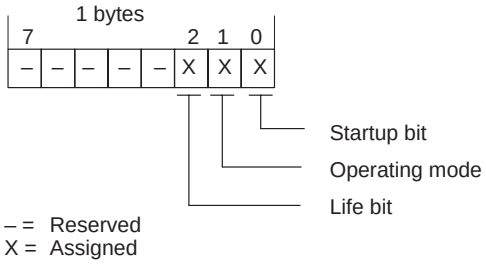


Figure 7-8 Significance of the bits in the coordination area

Startup bit

The startup bit is set to 0 for a short time during the start–up routine by the operating unit. After the startup routine has been completed, the bit is set permanently to 1.

Operating mode

As soon as the operating unit has been switched offline by the operator, the operating mode bit is set to 1. When the operating unit is working in normal operation, the operating mode bit is set to 0. The PLC program can be used to poll this bit and thus establish the current operating mode of the operating unit.

Life bit

The life bit is inverted by the operating unit at intervals of one second. The PLC program can be used to poll this bit to check whether connection to the operating unit still exists.

7.8 Transferring Date and Time to the PLC

Transferring date and time

Transfer of date and time from the operating unit to the PLC can be triggered by PLC jobs 40 and 41. Both can be used to write the date and time to the data area Date/Time where they can be analyzed by the PLC program.

The jobs differ in respect of the format in which the information is stored. PLC job 40 writes in the format S7 DATE_AND_TIME, and PLC job 41 uses the same format as the operating unit. Both formats are in BCD code.

S7 DATE_AND_TIME format (BCD format)

The format used by PLC job 40 has the following structure:

Byte	7 4	3 0
n+0	Year (1995...2083)	
n+1	Month (01 – 12)	
n+2	Day (1...31)	
n+3	Hour (0...23)	
n+4	Minute (0...59)	
n+5	Second (0...59)	
n+6	Reserved	Reserved
n+7	Reserved	Weekday (1...7, 1=Sun)

Figure 7-9 Structure of data area Date/Time in S7 DATE_AND_TIME format

Operating unit format (BCD format)

The format used by PLC job 40 has the following structure:

Byte	7 0
n+0	Reserved
n+1	Hour (0...23)
n+2	Minute (0...59)
n+3	Second (0...59)
n+4	Reserved
n+5	Reserved
n+6	Reserved
n+7	Weekday (1...7, 1=Sun)
n+8	Day (1...31)
n+9	Month (1...12)
n+10	Year (0...99)
n+11	Reserved

Figure 7-10 Structure of data area Date/Time in operating unit format

Differences of the S7 format as compared to the operating unit format

The S7 DATE_AND_TIME format differs from the operating mode format in the following ways:

- Different sequence of entries
- Details of 1/10, 1/100 and 1/1000 seconds integrated in the format
- Memory requirements reduced from 12 to 8 bytes

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Communication Management for WinLC

8

General information

This chapter describes the communication between the operating unit and SIMATIC WinLC (Windows Logical Controller). WinLC belongs to the basic WinAC packet (Windows Automation Center). WinLC is a PC–based automation system and belongs to the S7 automation system product range (S7–300 and S7–400). It supports the decentalized periphery using PROFIBUS–DP. A system condition for using WinLC is Microsoft Windows NT Version 4.0 or later.

Condition

WinLC and ProTool/Pro RT must be installed on the PC.

Supported operating units

The following operating units can be connected to the SIMATIC WinLC:

– PC with Windows NT V4.0 or later

Installation

The driver for connection to the WinLC is supplied with the configuration software and runtime, and installed automatically.

A condition for its use is that WinLC has been installed and configured according to the *Windows Logical Controller (WinLC)* user guide. Connection of the operating unit to the WinLC only involves setting the PLC. The PLC is set either when starting a new project by using the assistant or in the project window under item object type *PLC*.

8.1 Basic Methods of Functioning

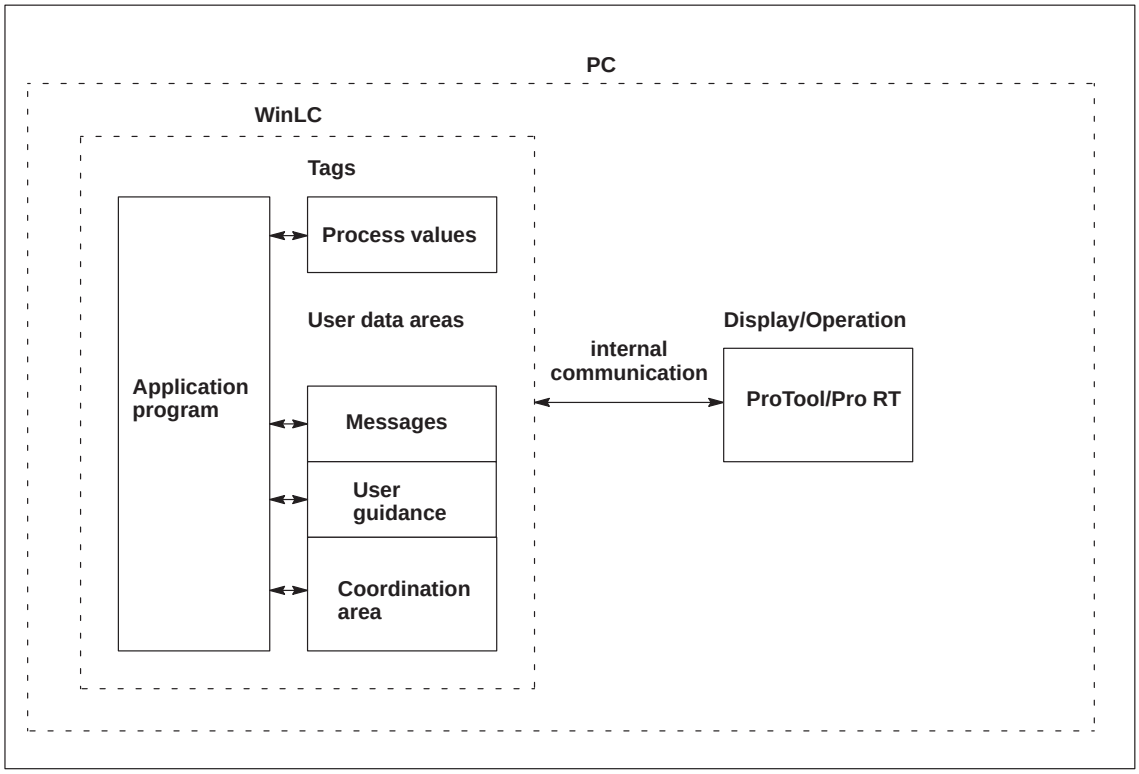


Figure 8-1 Communication structure

Task of the tags

The general exchange of data between SIMATIC S7 and operating unit is performed via the process values. To do this, tags must be specified in the configuration which point to an address in the S7. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit, which is then written to the address in the S7.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data areas are required for:
- Messages,
- Trends,
- PLC jobs,
- Controlling LEDs,
- Life bit monitoring.

A detailed description of the user data areas is provided in Chapter 9.

8.2 Data Types Available

Supported data types

When configuring tags and area pointers, the data types listed in Table 8-1 are available for use:

Table 8-1 Data types available

Data types supported for WinLC		
Data type	**Addressed by**	**Format**
Data block	DB, M	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, TIMER, COUNTER
Memory	M	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, TIMER, COUNTER
Input	E	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL
Peripheral input	PE	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL
Output	A	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL
Peripheral output	PA	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL
Timer	T	Timer
Counter	Z	Counter

User Data Areas for WinLC

9

User data areas are used for data exchange between the PLC and operating unit.

These data areas are written to and read by the operating unit and the application program alternately during the process of communication. By analyzing the data stored there, the PLC and operating unit reciprocally initiate predefined actions.

This chapter describes the function, layout and special features of the various user data areas.

9.1 Overview

Definition

User data areas can be located in data blocks and memory areas in the PLC. User data areas include messages and trends. Set up user data areas both in the configuration, using menu item *System* → *Area Pointer* and in the PLC.

Function range

The user data areas available is dependent on the operating unit used. Table 9-1 summarizes the range of functions available on the individual operating units.

Table 9-1 Applicable user data areas

User data area	PC
Event messages	X
Alarm messages	X
Aknowledgement area	X
LED assignment	–
Trend request area	X
Trend transfer areas	X
Screen number	X
PLC jobs	X
Coordination area	X
Date and time	X

Table 9-2 indicates who is reading (**R**) and who is writing (**W**) in respect of access to the individual data areas.

Table 9-2 Use of data areas

Data area	Necessary for	Operating unit	PLC
Event messages	Configured event messages	R	W
Alarm messages	Configured alarm messages	R	W
PLC acknowledge-ment	Alarm message acknowledge-ment from the PLC	R	W
OP acknowledgement	Message from the operating unit to the PLC indicating an alarm message has been acknowledged	W	R
Trend request	Configured trends with “Trig-gering via bit” or configured history trends	W	R

Table 9-2 Use of data areas, continued

Data area	Necessary for	Operating unit	PLC
Trend transfer 1	Configured trends with “Triggering via bit” or configured history trends	R/W	R/W
Trend transfer area 2	Configured history trend with “switch buffer”	R/W	R/W
Screen number	Evaluation by the PLC as to which screen is currently open	W	R
PLC jobs	Triggering of functions on the operating unit by PLC program	R/W	R/W
Coordination area	Operating unit status polled by the PLC program	W	R
Date and time	Transfer of date and time from the operating unit to the PLC	W	R

9.2 Event and Alarm Messages

Definition

Messages consist of a static text and/or tags. The text and tags can be defined by the user.

Messages are subdivided into event messages and alarm messages. The programmer defines the event message and alarm message.

Event message

An event message indicates a status, e.g.

- `Motor switched on`
- `PLC in manual mode`

Alarm message

An alarm message indicates an operational fault, e.g.

- `Valve not opening`
- `Motor temperature too high`

Acknowledgement

Since alarm messages indicate an abnormal operational status, they must be acknowledged. They can be acknowledged either by

- operator input on the operating unit
- setting a bit in the PLC acknowledgement area.

Triggering messages

A message is triggered by setting a bit in one of the message areas on the PLC. The location of the message areas is defined by means of the configuration software. The corresponding area must also be set up in the PLC.

As soon as the bit in the PLC event/alarm message area has been set and that area has been transferred to the operating unit, the operating unit detects that the relevant message has “arrived”.

Conversely, when the same bit is reset on the PLC by the operating unit, the message is registered as having “departed”.

Message areas

Table 9-3 indicates the number of message areas for event and alarm messages, the number of alarm message acknowledgement areas (PLC → Operating Unit and Operating Unit → PLC) and the total length of the respective areas for the various operating units.

Table 9-3 Operating unit message areas

Unit	**Event message area**		**Alarm messages area/ Alarm message acknowledgement area**	
	Number	**Length** (words)	**Number per type**	**Overall length per type** (words)
PC	8	125	8	125

Assignment of message bit and message number

A message can be configured for each bit in the message area configured. The bits are assigned to the message numbers in ascending order.

Example:

Assume that the following event message area has been configured for the WinLC:

`DB 60 Address 42 Length 5` (in words)

Figure 9-1 illustrates the assignment of all 80 (5 x 16) message numbers to the individual bit numbers in the PLC event message area.

The assignment is performed automatically on the operating unit.

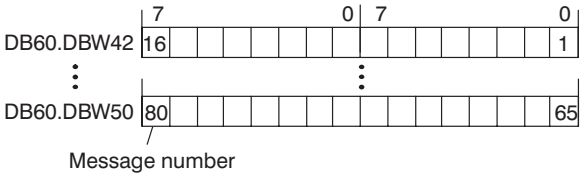


Figure 9-1 Assignment of message bit and message number

Acknowledgement areas

If the PLC should be informed of an alarm message acknowledgement on the operating unit or the acknowledgement should be initiated on the PLC itself, the relevant acknowledgement areas must also be set up in the PLC. These acknowledgement areas must also be specified in the configuration.

- **Acknowledgement area Operating Unit → PLC**:
  This area is used to inform the PLC when an alarm message has been acknowledged by means of operator input on the operating unit. In this case, the area pointer “OP acknowledgement” must be set.
- **Acknowledgement area PLC → Operating Unit**:
  This area is used when an alarm message is acknowledged by the PLC. In this case, the area pointer “PLC acknowledgement” must be set.

These acknowledgement areas must also be specified in the configuration under *Area Pointers*.

Figure 9-2 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 9-4 and 9-5.

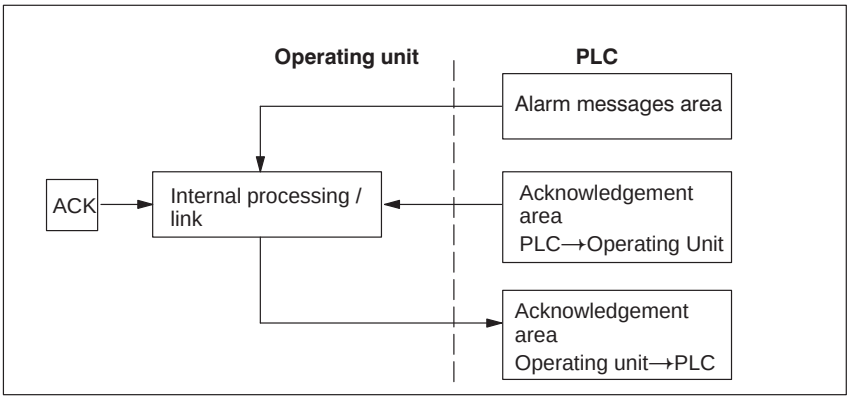


Figure 9-2 Alarm message and acknowledgement areas

Assignment of acknowledgement bit to message number

Each alarm message is assigned a message number. The message number is assigned the same bit number in the alarm messages area as that assigned in the acknowledgement area. Under normal circumstances, the acknowledgement area is the same length as the associated alarm messages area.

If the length of an acknowledgement area is not equal to the overall length of the associated alarm messages area, and there are succeeding alarm messages and acknowledgement areas, the following assignment applies:

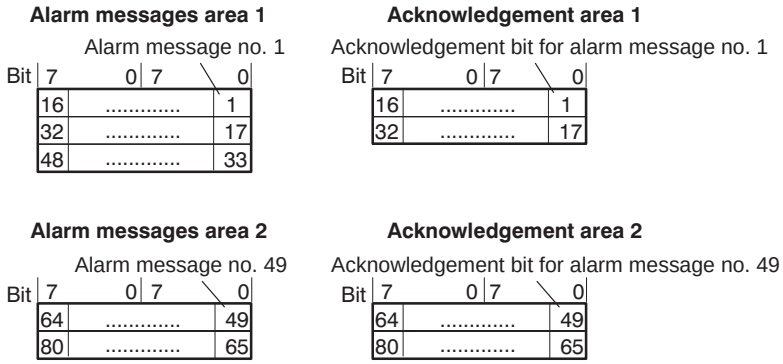

Alarm messages area 1
Alarm message no. 1
Bit 7 0 7 0
16 1
32 17
48 33
Acknowledgement area 1
Acknowledgement bit for alarm message no. 1
Bit 7 0 7 0
16 1
32 17
Alarm messages area 2
Alarm message no. 49
Bit 7 0 7 0
64 49
80 65
Acknowledgement area 2
Acknowledgement bit for alarm message no. 49
Bit 7 0 7 0
64 49
80 65

Figure 9-3 Assignment of acknowledgement bit and message number

Acknowledgement area PLC → Operating Unit

A bit set in this area by the PLC initiates the acknowledgement of the corresponding alarm message in the operating unit, thus fulfilling the same function as pressing the “ACK” key. Reset the bit before setting the bit in the alarm message area again. Figure 9-4 shows the signal diagram.

The acknowledgement area PLC→ Operating Unit

- must follow on immediately from the associated alarm messages area,
- must have precisely the same polling time and
- may not be any longer than the associated alarm messages area.

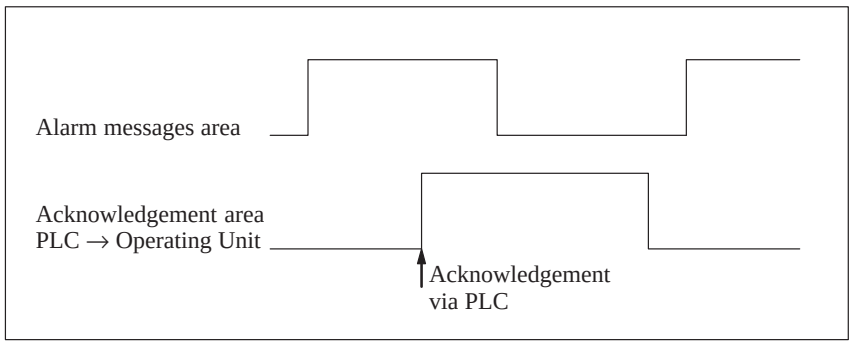


Figure 9-4 Signal diagram for acknowledgement area PLC → Operating Unit

Acknowledgement area Operating Unit → PLC

When a bit is set in the alarm message area, the operating unit resets the associated bit in the acknowledgement area. As a result of processing by the operating unit, the two processes indicate a slight difference with regard to time. If the alarm message is acknowledged on the operating unit, the bit in the acknowledgement area is set. In this way, the PLC can detect that the alarm message has been acknowledged. Figure 9-5 shows the signal diagram.

The acknowledgement area Operating Unit → PLC must be no longer than the associated alarm messages area.

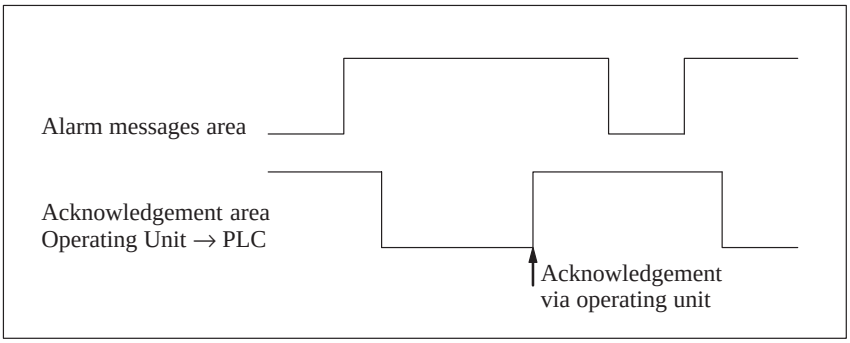


Figure 9-5 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area size

The acknowledgement areas PLC → Operating Unit and Operating Unit → PLC must not be any longer than the associated alarm message areas. They can, however, be smaller if acknowledgement by the PLC is not required for all alarm messages. This is also valid when the acknowledgement need not be detected in the PLC for all alarm messages. Figure 9-6 illustrates such a case.

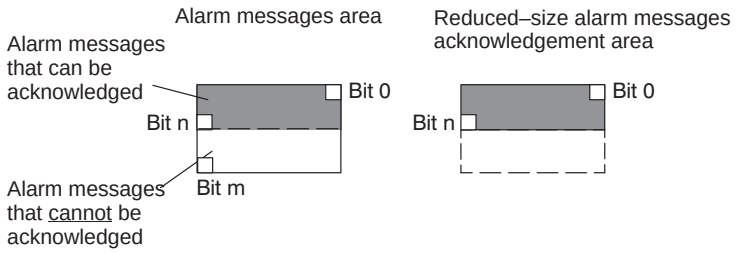


Figure 9-6 Reduced–size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 0 in ascending order.

9.3 Trend Request and Transfer Areas

Trends

A trend is the graphical representation of a value from the PLC. Reading of the value can be time-triggered or bit-triggered, depending on the configuration.

Time-triggered trends

The operating unit reads in the trend values cyclically, according to the time interval defined in the configuration. Time-triggered trends are suitable for continuous progressions such as the operating temperature of a motor.

Bit-triggered trends

By setting a trigger bit, the operating unit reads in either a trend value or the entire trend buffer. This is specified in the configuration. Bit-triggered trends are normally used to display values of an area subject to rapid variation. An example of this is the injection pressure for plastic mouldings.

In order to be able to activate bit-triggered trends, corresponding data areas have to be specified in the configuration (under *Area Pointers*) and set up on the PLC. The operating unit and the PLC communicate with one another via those areas.

The following areas are available for trends:
- Trend request area
- Trend transfer area 1
- Trend transfer area 2 (required with switch buffer only)

Assign a trend to a bit in the configuration. This ensures the bit assignment is unique for all areas.

Switch buffer

The switch buffer is a second buffer for the same trend and can be set up during the configuration.

While the operating unit reads the value from Buffer 1, the PLC writes it in Buffer 2. If the operating unit reads from Buffer 2, the PLC writes to Buffer 1. This prevents the trend value being overwritten by the PLC when being read by the operating unit.

Data area division

The individual areas, namely trend request area and trend transfer areas 1 and 2, can be divided into separate data areas with a predefined maximum number and length (Table 9-4).

Table 9-4 Division of data areas

	Data areas		
	Request	Transfer	
		1	2
Max. number per type	8	8	8
Overall length of all data areas (words)	8	8	8

Trend request area

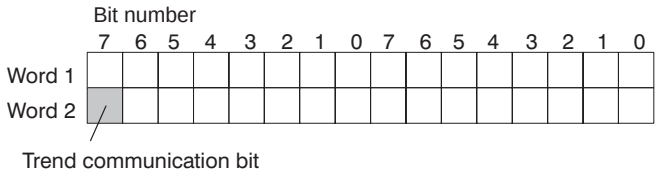
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

The trend request area can be used by the PLC to ascertain which trend is currently being displayed on the operating unit. Trends can also be triggered without analysis of the trend request area.

Trend transfer area 1

This area serves to trigger trends. In the PLC program, set the bit assigned to the trend in the trend transfer area and the trend communication bit. The operating unit detects triggering and reads in either a trend value or the entire buffer, according to the configuration. It then resets resets the trend bit and the trend communication bit .

Trend transfer area(s)



The trend transfer area must not be altered by the PLC program until the trend communication bit has been reset.

Trend transfer area 2

Trend transfer area 2 is necessary for trends that are configured with a switch buffer. Its layout is precisely the same as that of trend transfer area 1.

9.4 Screen Number Area

Application

The operating units store information concerning the screen currently open on the unit in the screen number area.

This enables the transfer of data regarding the current operating unit display content to the PLC which, in turn, can trigger certain reactions; e.g. call in a different screen.

Condition

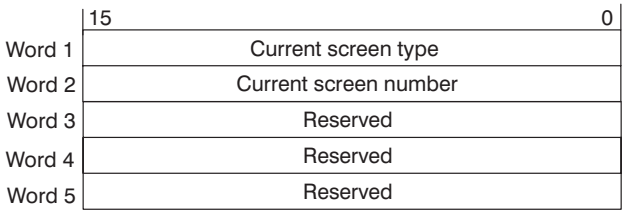
If the screen number area should be used, it must be specified in the configuration as an *Area Pointer*. It can only be stored in one PLC and only once.

The screen number area is downloaded to the PLC spontaneously, i.e. the transfer is always initiated when a change is registered on the operating unit. Therefore, it is not necessary to configure a polling time.

Structure

The screen number area is a data area with a fixed length of data words.

The structure of the screen number area in the PLC memory is illustrated below.



Entry	Assignment
Current screen type	1
Current screen number	1 to 65535

9.5 Using PLC Jobs

Description

PLC jobs can be used to initiate functions on the operating unit from the PLC. These functions include:

- Displaying screens
- Setting date and time

A PLC job is identified by its job number. Depending on the PLC job in question, up to three parameters can then be specified.

Job mailbox

The job mailbox can be used to send PLC jobs to the operating unit, thus initiating actions on the operating unit.

The job mailbox is set up under *Area pointer* and has a length of four data words.

The first word of the job mailbox contains the job number. The parameters of the job must be entered in the succeeding words (maximum of 3).

Word	Left byte (LB)	Right byte (RB)
n+0	0	Job no.
n+2	Parameter 1	
n+4	Parameter 2	
n+6	Parameter 3	

Figure 9-7 Structure of the job mailbox data area

If the first word of the job mailbox is not equal to zero, the operating unit analyzes the PLC job. The operating unit then sets this data word to zero again. For this reason, the parameters must be entered in the job mailbox first and then the job number.

The PLC jobs possible are listed in the Appendix B together with their job numbers and parameters.

9.6 Coordination Area

The coordination area is two data words long. It serves to realize the following functions:

- Detection of operating unit startup by the PLC program,
- Detection of the current operating unit operating mode by the PLC program,
- Detection by the PLC program that the operating unit is ready to communicate.

Note

Each time the coordination area is updated by the operating unit, the entire coordination area is written.

Therefore, the PLC program must not execute any modifications in the coordination area.

In order to use the coordination area, both data words must be specified, whereby the first data word is used. The second data word is reserved. Figure 9-8 illustrates the structure of Byte 1 in the first data word.

Bit assignment in coordination area

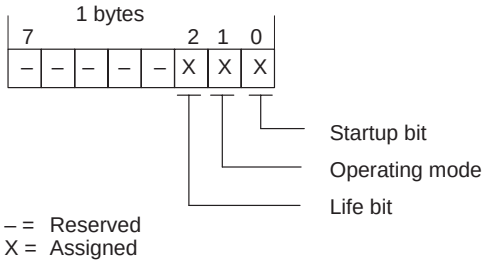


Figure 9-8 Significance of the bits in the coordination area

Startup bit

The startup bit is set to 0 for a short time during the start–up routine by the operating unit. After the startup routine has been completed, the bit is set permanently to 1.

Operating mode

As soon as the operating unit has been switched offline by the operator, the operating mode bit is set to 1. When the operating unit is working in normal operation, the operating mode bit is set to 0. The PLC program can be used to poll this bit and thus establish the current operating mode of the operating unit.

Life bit

The life bit is inverted by the operating unit at intervals of one second. The PLC program can be used to poll this bit to check whether connection to the operating unit still exists.

9.7 Transferring Date and Time to the PLC

Transferring date and time

Transfer of date and time from the operating unit to the PLC can be triggered by PLC jobs 40 and 41. Both can be used to write the date and time to the data area Date/Time where they can be analyzed by the PLC program.

The jobs differ in respect of the format in which the information is stored. PLC job 40 writes in the format S7 DATE_AND_TIME, and PLC job 41 uses the same format as the operating unit. Both formats are in BCD code.

S7 DATE_AND_TIME format (BCD format)

The format used by PLC job 40 has the following structure:

Byte	7 4	3 0
n+0	Year (1995...2083)	
n+1	Month (01 – 12)	
n+2	Day (1...31)	
n+3	Hour (0...23)	
n+4	Minute (0...59)	
n+5	Second (0...59)	
n+6	1/10 seconds (0...9)	1/100 Seconds (0...9)
n+7	1/1000 second (0...9)	Weekday (1...7, 1=Sun)

Figure 9-9 Structure of data area Date/Time in S7 DATE_AND_TIME format

Operating unit format (BCD format)

The format used by PLC job 40 has the following structure:

Byte	7 0
n+0	Reserved
n+1	Hour (0...23)
n+2	Minute (0...59)
n+3	Second (0...59)
n+4	Reserved
n+5	Reserved
n+6	Reserved
n+7	Weekday (1...7, 1=Sun)
n+8	Day (1...31)
n+9	Month (1...12)
n+10	Year (0...99)
n+11	Reserved

Figure 9-10 Structure of data area Date/Time in operating unit format

Differences of the S7 format as compared to the operating unit format

The S7 DATE_AND_TIME format differs from the operating mode format in the following ways:

- Different sequence of entries
- Details of 1/10, 1/100 and 1/1000 seconds integrated in the format
- Memory requirements reduced from 12 to 8 bytes

Part V Connection to SIMATIC 505

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Communication Management for SIMATIC 505

10

This chapter describes communication between the operating unit and the PLC. The communication driver for serial connection to the SIMATIC 505 PLC is used. The connection is a point-to-point connection which is operated via the internal PLC protocol NITP.

Supported operating units

The following operating units can be connected to the SIMATIC 505:

- PC
- OP37/Pro
- MP270

Known restrictions

An RS422 connection to the SIMATIC 575–VME is not currently supported.

When the CPU 560–2120 and CPU 560–2820 series are used and the special functions CPUs 565–2120 and 565–2820 are implemented, access to the S Memory data types (special user data types) is not possible. The standard data types can be used as normal.

Installation

The driver for connection to the SIMATIC 505 is supplied with the configuration software and installed automatically. With ProTool, the parameters for connection to the PLC must also be set. Please refer to the corresponding chapter on connection types for information regarding which parameters are necessary on the PLC side to connect the operating unit.

Program for controlling the DP driver

A PLC program is necessary which controls the driver in order to connect a PROFIBUS–DP. An example program is supplied with ProTool (written in LADDER) which can be adapted for individual requirements. The example program supports linear P–addressing. The example program is located in the directory `PROTOOL\PLCPROG\SIMATIC_505`.

Compatibility of ProTool V5.0 and V5.1

ProTool V5.1 does not support exactly the same data formats as ProTool V5.0x for some SIMATIC 505. However, it is still possible to used your configuration. After calling in the configuration using ProTool V5.1, the configuration window item object type *Tags* displays “invalid data format”. The configuration can be edited but not created.

Call in the dialog box for the tag with a double click. The old, invalid data format is displayed. Change the data format to a valid one.

10.1 Supported Data Types

When configuring tags and area pointers, the user data types listed in Table 6-1 are available for use. The condition for this is that those data areas have also been set up in TISOFT for the CPU.

Table 10-1 Permissible data areas for the operating unit

User data type	Addressed by	Format
Discrete Input	X	Bit
Discrete Output	Y	Bit
Control Relay	C	Bit
Tag Memory	V[1)]	Bit +/– INT INT +/– DOUBLE DOUBLE REAL ASCII
Word Input	WX[1)]	
Word Output	WY[1)]	
Constant Memory	K[1)]	
Status Word Memory	STW[1)]	
Timer/Counter Preset	TCP[1)]	+/– INT INT
Timer/Counter Current	TCC[1)]	
Analog Alarm		
Process Loop		
Special Function		

1) When connected to the PROFIBUS–DP, only this user data type is supported in the example program.

Analog Alarm, *Process Loop* and *Special Function* are general terms for a number of special user data types. If these collective terms are selected in the dialog box *Tag*, an additional selection list appears in which the actual user data types can be set (refer to Tables 10-2 to 10-4).

Table 10-2 Analog Alarm

User data type	Addressed by	Format
Analog Alarm/Alarm Acknowledge Flags	AACK	+/–INT, INT
Analog Alarm Deadband	AADB	+/–INT, INT, REAL
Most Significant Word of Analog Alarm C–flags	ACFH	+/–INT, INT
Least Significant Word of Analog Alarm C–flags	ACFL	+/–INT, INT
Analog Alarm Error	AERR	+/–INT, INT, REAL
Analog Alarm High Alarm Limit	AHA	+/–INT, INT, REAL
Analog Alarm High–High Alarm Limit	AHHA	+/–INT, INT, REAL
Analog Alarm Low Alarm Limit	ALA	+/–INT, INT, REAL
Analog Alarm Low–Low Alarm Limit	ALLA	+/–INT, INT, REAL
Analog Alarm Orange Deviation Alarm Limit	AODA	+/–INT, INT, REAL
Analog Alarm Process Tag	APV	+/–INT, INT, REAL
Analog Alarm Process Tag High Limit	APVH	REAL
Analog Alarm Process Tag Low Limit	APVL	REAL
Analog Alarm Rate of Change Alarm Limit	ARCA	REAL
Analog Alarm Setpoint	ASP	+/–INT, INT, REAL
Analog Alarm SP High Limit	ASPH	+/–INT, INT, REAL
Analog Alarm SP Low Limit	ASPL	+/–INT, INT, REAL
Analog Alarm Sample Rate	ATS	REAL
Analog Alarm Flags	AVF	+/–INT, INT
Analog Alarm Yellow Deviation Alarm Limit	AYDA	+/–INT, INT, REAL
Alarm Peak Elapsed Time	APET	+/–INT, INT

Table 10-3 Process Loop

User data type	Addressed by	Format
Loop Alarm/Alarm Acknowledge Flags	LACK	+/–INT, INT
Loop Alarm Deadband	LADB	+/–INT, INT, REAL
Most Significant Word of Loop C–flags	LCFH	+/–INT, INT
Least Significant Word of Loop C–flags	LCFL	+/–INT, INT
Loop Error	LERR	+/–INT, INT, REAL
Loop Alarm High Limit	LHA	+/–INT, INT, REAL
Loop Alarm High–High Limit	LHHA	+/–INT, INT, REAL
Loop Gain	LKC	REAL
Loop Derivative Gain Limiting Coefficient	LKD	REAL
Loop Low Alarm Limit	LLA	+/–INT, INT, REAL
Loop Low–Low Alarm Limit	LLLA	+/–INT, INT, REAL
Loop Output	LMN	+/–INT, INT, REAL
Loop Bias	LMX	+/–INT, INT, REAL
Loop Orange Deviation Limit	LODA	+/–INT, INT, REAL
Loop Process Tag	LPV	+/–INT, INT, REAL
Loop PV High Limit	LPVH	REAL
Loop PV Low Limit	LPVL	REAL
Loop Rate of Change Alarm Limit	LRCA	REAL
Loop Ramp/Soak Flags	LRSF	+/–INT, INT
Loop Ramp/Soak Step Number	LRSN	+/–INT, INT
Loop Setpoint	LSP	+/–INT, INT, REAL
Loop Setpoint High Point	LSPH	+/–INT, INT, REAL
Loop Setpoint Low Limit	LSPL	+/–INT, INT, REAL
Loop Rate	LTD	REAL
Loop Reset	LTI	REAL
Loop Sample Rate	LTS	REAL
Loop V–flags	LVF	+/–INT, INT
Loop Yellow Deviation Alarm Limit	LYDA	+/–INT, INT, REAL
Loop Peak Elapsed Time	LPET	+/–INT, INT

Table 10-4 Special Function

User data type	Addressed by	Format
SF Program Peak Elapsed Time	PPET	+/–INT, INT
SF Subroutine Peak Elapsed Time	SPET	+/–INT, INT

10.2 Optimization

Acquisition cycle and update times

The acquisition cycles defined in the configuration software for the *area pointers* and for the tags are major factors in respect of the real update times which are achieved. The update time is the acquisition cycle plus transmission time plus processing time.

In order to achieve optimum update times, the following points should be observed during configuration:

- When setting up the individual data areas, make them as large as necessary but as small as possible.
- Define data areas that belong together as contiguous areas. The effective update time is improved by setting one single large area rather than several smaller areas.
- Setting acquisition cycles which are too short unnecessarily impairs overall performance. Set the acquisition cycle to correspond to the modification time of the process values. The rate of change of temperature of a furnace, for example, is considerably slower than the acceleration curve of an electric motor.

  Guideline value for the acquisition cycle: Approx. 1 second.
- If necessary, dispense with cyclic transmission of user data areas (acquisition cycle = 0) in order to improve the update time. Instead, use PLC jobs to transfer the user data areas at random times.
- Store the tags for a message or a screen in a contiguous data area.
- In order that changes on the PLC are reliably detected by the operating unit, they must occur during the actual acquisition cycle at least.

Screens

The real updating rate which can be achieved is dependent on the type and quantity of data to be displayed.

In order to achieve short updating times, ensure that short acquisition cycles are only defined in the configuration for those objects which actually need to be updated quickly.

Trends

If, in the case of bit–triggered trends, the communication bit is set in the *trend transfer area*, the operating unit always updates all the trends whose bit is set in that area. It resets the bits afterwards.

The communication bit in the PLC program may only be set again after all the bits have been reset by the operating unit.

PLC jobs

If large numbers of PLC jobs are sent to the operating unit in quick succession, communication between the operating unit and PLC may become overloaded.

If the operating unit enters the value 0 in the first data word of the job mailbox, it signifies that the operating unit has accepted the job. It then processes the job, for which it requires a certain amount of time. If a new PLC job is then immediately entered in the job mailbox, it may take some time before the operating unit executes the next PLC job. The next PLC job is only accepted when sufficient computer performance is available.

Connection Via NITP

11

This chapter describes the communication between the operating unit and SIMATIC 505 using a serial connection via NITP.

Installation

The driver for connection to the SIMATIC 505 is supplied with the configuration software and installed automatically.

Connection of the operating unit to the SIMATIC 505 is basically restricted to the physical connection. Special function blocks for connection to the PLC are not required.

Connection

No additional communication modules are required in order to connect the operating unit to the SIMATIC 505. Communication can be performed via one of the standard ports provided in the system. This is the COM port in the case of a PC and the IF1 interface with an OP37/Pro and MP270. On the PLC side, the operating unit should be connected to the CPU programming interface (RS232 or RS422). Please refer to Table 11-1 for information on which cable to use.

Details of which interface to use on the operating unit are provided in the relevant equipment manual.

Table 11-1 Applicable connection cables

	SIMATIC 505			
	V.24, 9–pin	V.24, 25–pole	RS422, 9–pole*)	RS422, 9–pin**)
All operating units (except PC) V.24, 15–pin	6XV1 440–2K_ _ _	6VX1 440–2L_ _ _	–	–
All operating units (except PC) RS422, 9–pin	–	–	6XV1 440–2M_ _ _	6XV1 440–1M_ _ _
PC (COM1, COM2)	SIMATIC 505 standard cable PPX 260 109–0001	SIMATIC 505 standard cable PPX 260 109–0001	Commercial V24/RS422 converter	Commercial V24/RS422 converter

'_' = Length code
*) for SIMATIC 505 (PLC 535, PLC 545 – 1101, PLC 565T)
**) for SIMATIC 505 (PLC 545 – 1102, PLC 555)

11.1 Basic Methods of Functioning

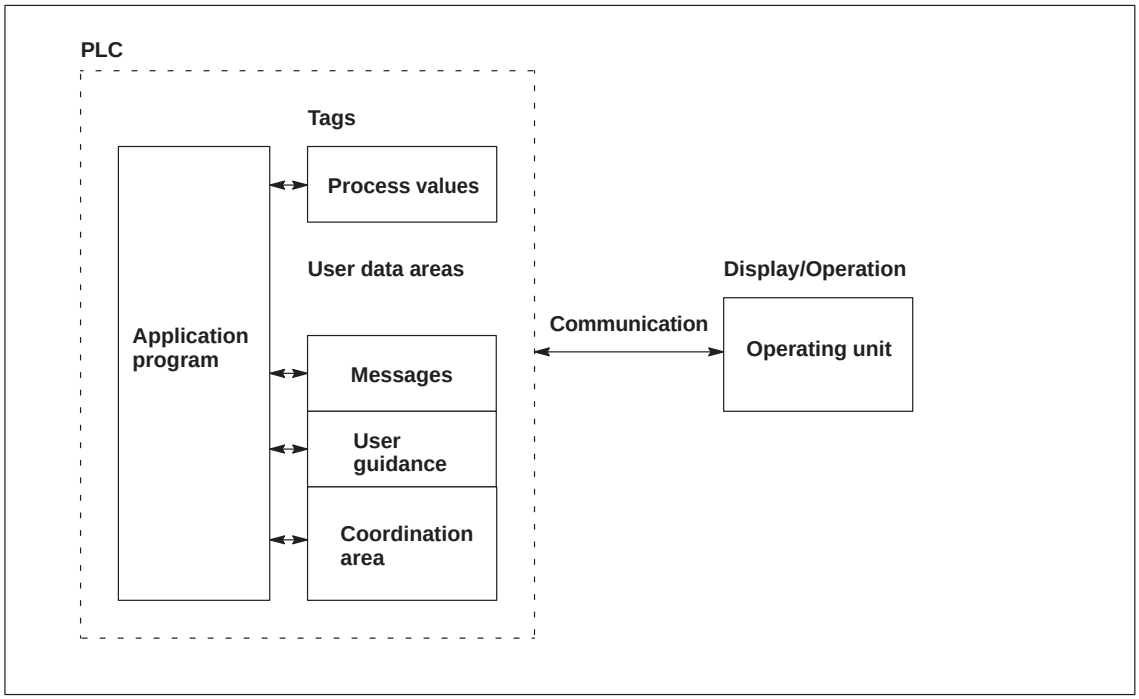


Figure 11-1 Communication structure

Task of the tags

The general data exchanged between SIMATIC 505 and operating unit is performed by means of process values. To do this, tags must be specified in the configuration which point to an address in the SIMATIC 505. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit which is then written to the address in the SIMATIC 505.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data areas are required for:
- Messages,
- Trends,
- PLC jobs,
- Controlling LEDs,
- Life bit monitoring.

A detailed description of the user data areas is provided in Chapter 13.

11.2 Configuring SIMATIC 505 for NITP

When creating a new project, the project assistant requests the definition of the PLC. First of all, select the protocol `SIMATIC 505 V5.1` and then define the following parameters after clicking on the button *Parameter.* For any subsequent parameter modifications, select the item *PLC* in the project window.

Define the following parameters for the PLC:

Table 11-2 PLC parameters

Parameter	Explanation
Interface	The operating unit interface to which the SIMATIC 505 is connected must be set here. When using a PC, this can be COM1 or COM2. In the case of OP37/Pro and MP270, this can be interface IF1A or IF1B, depending on the physics implemented. Also, in the case of the OP37/Pro, the interface actually used must be set in the BIOS. If the interface IF1A is used with RS232, no modification is necessary. If the interface IF1B is used with RS422, select the mask *Integrated Peripherals* in the BIOS. Select the entry *Serial 1* and set the physics to `RS422/RS485 (IF1B)`.
Interface type	Select either RS232 or RS422.
Data bits	Set `7` here.
Parity	Set `ODD` here.
Stop bits	Set `1` here.
Baud rate	Set the transmission rate between operating unit and SIMATIC 505 here. The communication can be set to a baud rate of 19200, 9600, 4800, 2400, 1200, 600 or 300 baud.

PROFIBUS–DP Connection to SIMATIC 505 12

This chapter describes the communication between the operating unit and SIMATIC 505 via the PROFIBUS–DP.

Definition

PROFIBUS-DP is a Master-Slave field bus with up to 122 slaves. The PROFIBUS-DP network is normally operated by one master. This master polls all the slaves cyclically. The master is, for example, an AG with a standard DP–compatible connection module. Each operating unit is a slave and explicitly assigned to a master AG.

Hardware requirements

The following hardware components are required in order to integrate the operating units in an existing PROFIBUS–DP network:

- OP37/Pro, or
  MP270 or
  PC with communication processor CP5611 or CP5511
- In the PLC:
  CP5434–DP (Annex Card)
- For each unit (operating unit or AG):
  Bus connector PROFIBUS–DP or
  a different component approved for this installation (except FSK bus terminal, refer to Configuration in SIMATIC HMI Catalog ST80.1).

Software requirements

The following software components are also required for the PROFIBUS-DP connection:

- Configuration software ProTool/Pro from Version 5.1.
- Specific configuration software for standard DP-compatible configuration of the connection module.

Installation

The driver for connection to the SIMATIC 505 is supplied with the configuration software and installed automatically. A PLC program capable of controlling the driver is required for the connection to PROFIBUS–DP.

For connection of the operating unit to the SIMATIC 505, both the physical connection and a function block in the PLC are required. The function block is supplied with ProTool/Pro.

System limits

Within a network established via the PROFIBUS-DP, a maximum of 120 of the 122 slaves may be an operating unit. These values are theoretical limits. The real limits are determined by the memory capacity and performance capability of the PLC.

12.1 Basic Methods of Functioning

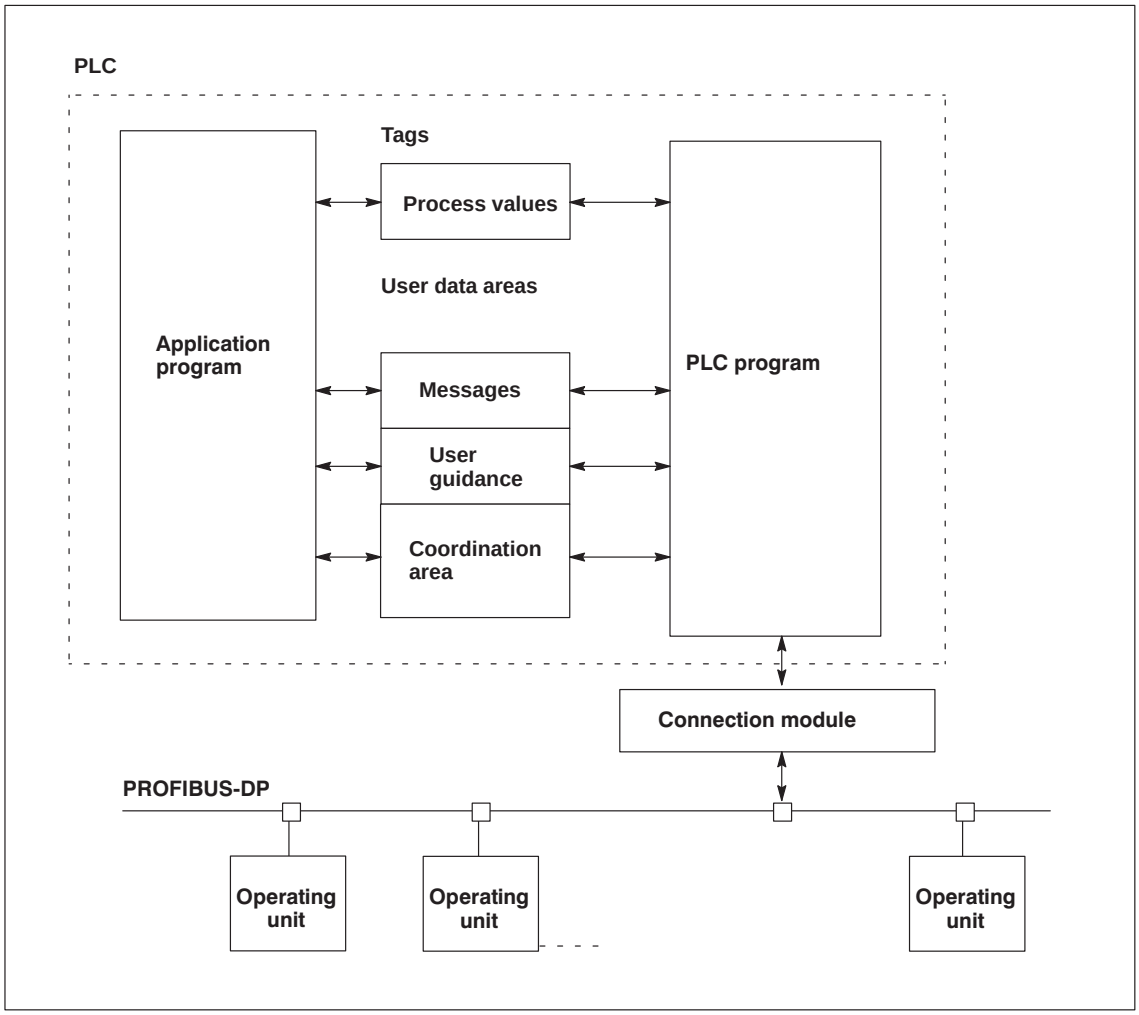


Figure 12-1 Communication structure of the PROFIBUS-DP connection

Task of the tags

The general data exchange between PLC and operating unit is performed via process values. To do this, tags must be specified in the configuration which point to an address in the PLC. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit, which is then written to the address in the PLC.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data areas are required for:
– Messages,
– Trends,
– PLC jobs,
– Controlling LEDs,
– Life bit monitoring.

A detailed description of the user data areas is provided in Chapter 13.

Program for controlling the DP driver

A PLC program is necessary which controls the driver in order to connect a PROFIBUS–DP. An example program is supplied with ProTool (written in LADDER) which can be adapted for individual requirements. The example program supports linear P–addressing. The example program is located in the directory `PROTOOL\PLCPROG\SIMATIC_505`.

The example program is designed for the CPU 545 and CPU 555 which are connected to the PROFIBUS–DP network via the CP 5434–DP (annex card). The following settings are defined in the example program and must be set identically in the configuration:

Program	Parameter	Value
ProTool	Operating unit	PC
	Protocol	SIMATIC 505 DP V5.1
	OP address	3
	Interface	DP/MPI
	Baud rate	1500 Baud
	Block length	Class B middle
COM Profibus	Master station type	505–CP5434–DP
	Type of addressing	Linear
	Slave address	3
	Station type	HMI PT/Pro PC
	Set configuration	Class B middle
	Configured to E–address	P000–P048
	Configured to A–address	P000–P016
TISOFT	I/O address	0100 for WX32 and WY16
	Area for data exchange	V900–V1020

Interface settings

The interface is setup as follows using Windows *Settings→ Control Panel → Set PU/PC interface*:

Access point of the application	DPSONLINE
Module configuration used	PROFIBUS-DP slave

12.2 Configuring SIMATIC 505 for PROFIBUS–DP

Parameter

When defining a new project, the project assistant requests the specification of a PLC. First of all, select the protocol `SIMATIC 500/505 DP V5.1` and then define the following parameters after clicking on the button *Parameter*. For any subsequent parameter modifications, select the item *PLC* in the project window.

Define the following parameters for the PLC:

Table 12-1 PLC parameters

Parameter	Explanation
OP address	PROFIBUS–DP address of the operating unit. Value range 3 to 126
Interface	Select the interface on the operating unit via which connection to the PLC is to be established. When using a PC, this is `DP/MPI`, and with the OP37/Pro and MP270, `IF1B`. In the case of the OP37/Pro, ASPC2 must also be activated in the BIOS. In the mask *Integrated Peripherals*, set the OP37/Pro BIOS entry *ASPC2* to `Enabled`.
Baud rate	The baud rate at which communication takes place over the network. The baud rate must be set identically for all the units in the network. The following baud rates are possible: – 93.75 kBit/s – 187.5 kBit/s – 500 kBit/s – 1.5 MBit/s (default) – 12 MBit/s
Set configuration	Used to define the I/O area implemented for the communication area between the operating unit and PLC. The size of the I/O area influences the performance. The set configuration must be realized according to Class B (basic DP slave complying to EN 50170). There are four different set configurations from which to choose: – Class B tiny – Class B small – Class B middle – Class B big Table 12-2 indicates the assignment of the I/O area.

The settings in ProTool/Pro must correspond to configuration specifications of the connection module CP5434–DP.

Set configuration

The assignment of the I/O area is explicitly defined with the four different settings. Table 12-2 provides details of the I/O area assignment.

Table 12-2 Assignment of the I/O area for Class B

Class	Inputs (Byte)	Outputs (Byte)
Class B tiny	32	22
Class B small	42	22
Class B middle	64	32
Class B big	128	64

In order to download large quantities of data, it is recommended to set a large I/O area. This ensures the screen displays on the operating unit are updated more quickly because the data is retrieved in one cycle.

12.3 Configuring the PROFIBUS–DP Network

Connection module CP5434–DP

The configuration packet COM PROFIBUS is required in order to configure the CP5434–DP. GSD files for operating unit slaves are supplied with ProTool/Pro. These GSD files are located in directory `\PROTOOL\PLCPROG\GSD`.

Different GSD files are required for the different operating units. Table 12-3 indicates the assignment.

Table 12-3 Assignment of GSD files and operating units

GSD file	Manufacturer ID	To 12 MBaud
SIEM8076.GSD	0x8076	PC
SIEM8077.GSD	0x8077	OP37/Pro
SIEM8078.GSD	0x8078	MP270

If the GSD files in the COM PROFIBUS directory `\PROTOCOL\PLCPROG\GSD` are older than those supplied with ProTool/Pro, or the COM PROFIBUS still does not support a new operating unit, copy the files from ProTool to COM PROFIBUS. Then restart COM PROFIBUS and select `Read GSD files`.

If a COM PROFIBUS configuration was created previously with an older file but the new GSD files are required for use, the configuration must be re–created.

Parameters

In order that the CP5434–DP and operating unit can communicate with each other, the following parameters must be set in COM PROFIBUS:

- **Station type**: *HMI*
- **Station number**: 3...126

  The value entered here must correspond with the OP address specified in the operating unit configuration.
- **Set configuration**:

  The set configuration is defined by selecting the class and the symbolic name of the name. The following set configurations can be set:
  – Class B tiny
  – Class B small
  – Class B middle
  – Class B big
- **Address ID**:

  The address ID is automatically assigned by the set configuration and must not be modified.
- **I and O address**:

  The address must correspond to that stored in the PLC program.

Integrating COM PROFIBUS configuration in TISOFT

The TISOFT documentation provides detailed information on how to integrate the COM PROFIBUS configuration in the TISOFT program. The basic steps are explained here briefly:

1. Generate a binary file in COM PROFIBUS using *Export*.
2. Install the binary file in the TISOFT program using *MERGE*.
3. Set the CPU to *ONLINE PLC Mode*.
4. Define the I/O addresses in TISOFT.
5. Download the program to the CPU using *UPDATE*.

User Data Areas for SIMATIC 505

13

User data areas are used for data exchange between the PLC and operating unit.

These data areas are written to and read by the operating unit and the application program alternately during the process of communication. By analyzing the data stored there, the PLC and operating unit reciprocally initiate predefined actions.

This chapter describes the function, layout and special features of the various user data areas.

13.1 Overview

Definition

User data areas can be located in data blocks and memory areas in the PLC. User data areas include messages and trends. Set up user data areas both in the configuration, using menu item *System → Area Pointer* and in the PLC.

Function range

The user data areas available are dependent on the operating unit used. Table 13-1 summarizes the range of functions available on the individual operating units.

Table 13-1 Applicable user data areas

User data area	PC	OP37/Pro	MP270
Event messages	X	X	X
Alarm messages	X	X	X
Aknowledgement area	X	X	X
LED assignment	–	X	X
Trend request area	X	X	X
Trend transfer areas	X	X	X
Screen number	X	X	X
PLC jobs	X	X	X
Coordination area	X	X	X
Date and time	X	X	X

Table 13-2 indicates who is reading (**R**) and who is writing (**W**) in respect of access to the individual data areas.

Table 13-2 Use of data areas

Data area	Necessary for	Operating unit	PLC
Event messages	Configured event messages	R	W
Alarm messages	Configured alarm messages	R	W
PLC acknowledge-ment	Alarm message acknowledge-ment from the PLC	R	W
Operating unit ac-knowledgement	Message from the operating unit to the PLC indicating an alarm message has been acknowledged	W	R
LED assignment (for OP and MP only)	LED triggered by the PLC	R	W

Table 13-2 Use of data areas, continued

Data area	Necessary for	Operating unit	PLC
Trend request	Configured trends with “Triggering via bit” or configured history trends	W	R
Trend transfer 1	Configured trends with “Triggering via bit” or configured history trends	R/W	R/W
Trend transfer area 2	Configured history trend with “switch buffer”	R/W	R/W
Screen number	Evaluation by the PLC as to which screen is currently open	W	R
PLC jobs	Triggering of functions on the operating unit by PLC program	R/W	R/W
Coordination area	Operating unit status polled by the PLC program	W	R
Date and time	Transfer of date and time from the operating unit to the PLC	W	R

13.2 Event and Alarm Messages

Definition

Messages consist of a static text and/or tags. The text and tags can be defined by the user.

Messages are subdivided into event messages and alarm messages. The programmer defines the event message and alarm message.

Event message

An event message indicates a status, e.g.

- `Motor switched on`
- `PLC in manual mode`

Alarm message

An alarm message indicates an operational fault, e.g.

- `Valve not opening`
- `Motor temperature too high`

Acknowledgement

Since alarm messages indicate an abnormal operational status, they must be acknowledged. They can be acknowledged either by

- operator input on the operating unit
- setting a bit in the PLC acknowledgement area.

Triggering messages

A message is triggered by setting a bit in one of the message areas on the PLC. The location of the message areas is defined by means of the configuration software. The corresponding area must also be set up in the PLC.

As soon as the bit in the PLC event/alarm message area has been set and that area has been transferred to the operating unit, the operating unit detects that the relevant message has “arrived”.

Conversely, when the same bit is reset on the PLC by the operating unit, the message is registered as having “departed”.

Message areas

Table 13-3 indicates the number of message areas for event and alarm messages, the number of alarm message acknowledgement areas (PLC → Operating Unit and Operating Unit → PLC) and the total length of the respective areas for the various operating units.

Table 13-3 Operating unit message areas

Unit	**Event message area**		**Alarm messages area/ Alarm message acknowledgement area**	
	Number	**Length** (words)	**Number per type**	**Overall length per type** (words)
PC	8	125	8	125
OP37/Pro	8	125	8	125
MP270	8	125	8	125

The length of a contiguous area may not exceed 64 words.

Assignment of message bit and message number

A message can be configured for each bit in the message area configured. The bits are assigned to the message numbers in ascending order.

Example:

Let us assume that the following event message area has been configured for the SIMATIC 500/505 PLC:

`V 43 Length 5` (in words)

Figure 13-1 shows the assignment of all 80 (5 x 16) message numbers to the individual bit numbers in the PLC event message area.

The assignment is performed automatically on the operating unit.

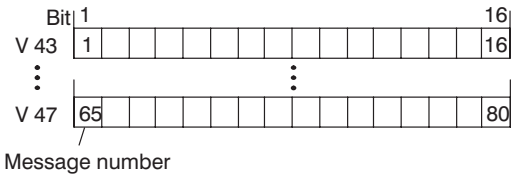


Figure 13-1 Assignment of message bit and message number

Acknowledgement areas

If the PLC should be informed of an alarm message acknowledgement on the operating unit or the acknowledgement should be initiated on the PLC itself, the relevant acknowledgement areas must also be set up in the PLC. These acknowledgement areas must also be specified in the configuration.

- **Acknowledgement area Operating Unit → PLC**:
  This area is used to inform the PLC when an alarm message has been acknowledged by means of operator input on the operating unit. In this case, the area pointer “OP acknowledgement” must be set.
- **Acknowledgement area PLC → Operating Unit**:
  This area is used when an alarm message is acknowledged by the PLC. In this case, the area pointer “PLC acknowledgement” must be set.

These acknowledgement areas must also be specified in the configuration under *Area Pointers*.

Figure 13-2 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 13-4 and 13-5.

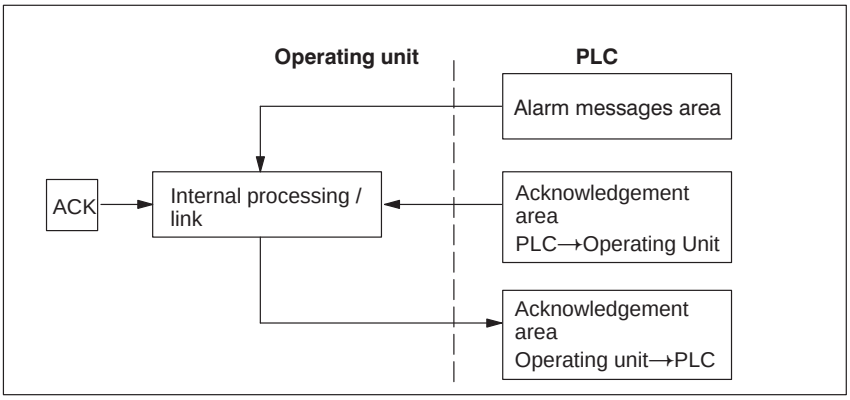


Figure 13-2 Alarm message and acknowledgement areas

Assignment of acknowledgement bit to message number

Each alarm message is assigned a message number. The message number is assigned the same bit number in the alarm messages area as that assigned in the acknowledgement area. Under normal circumstances, the acknowledgement area is the same length as the associated alarm messages area.

If the length of an acknowledgement area is not equal to the overall length of the associated alarm messages area, and there are succeeding alarm messages and acknowledgement areas, the following assignment applies:

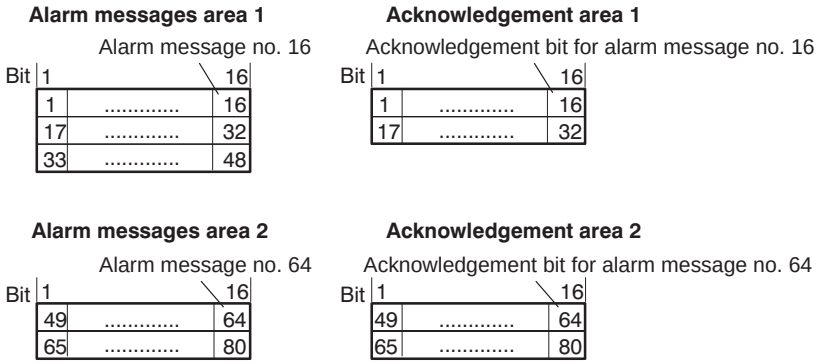


Figure 13-3 Assignment of acknowledgement bit and message number

Acknowledgement area PLC → Operating Unit

A bit set in this area by the PLC initiates the acknowledgement of the corresponding alarm message in the operating unit, thus fulfilling the same function as pressing the “ACK” key. Reset the bit before setting the bit in the alarm message area again. Figure 13-4 shows the signal diagram.

The acknowledgement area PLC → Operating Unit

- must follow on immediately from the associated alarm messages area,
- must have precisely the same polling time and
- may not be any longer than the associated alarm messages area.

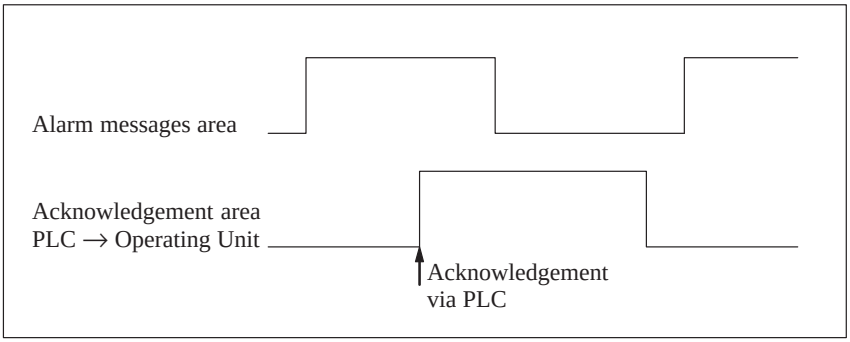


Figure 13-4 Signal diagram for acknowledgement area PLC → Operating Unit

Acknowledgement area Operating Unit → PLC

When a bit is set in the alarm message area, the operating unit resets the associated bit in the acknowledgement area. As a result of the processing via the operating unit, the two processes indicate a slight difference with regard to time. If the alarm message is acknowledged on the operating unit, the bit in the acknowledgement area is set. In this way, the PLC can detect that the alarm message has been acknowledged. Figure 13-5 shows the signal diagram.

The acknowledgement area Operating Unit → PLC can must be no longer than the associated alarm messages area.

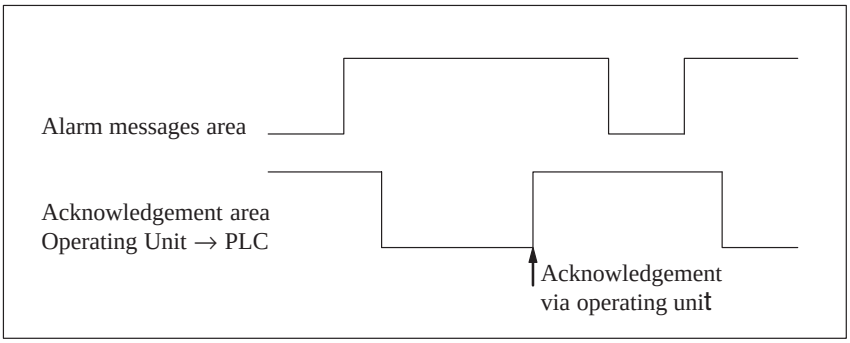


Figure 13-5 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area size

The acknowledgement areas PLC → Operating Unit and Operating Unit → PLC must not be any longer than the associated alarm message areas. They can, however, be smaller if acknowledgement by the PLC is not required for all alarm messages. This is also valid when the acknowledgement need not be detected in the PLC for all alarm messages. Figure 5-6 illustrates such a case.

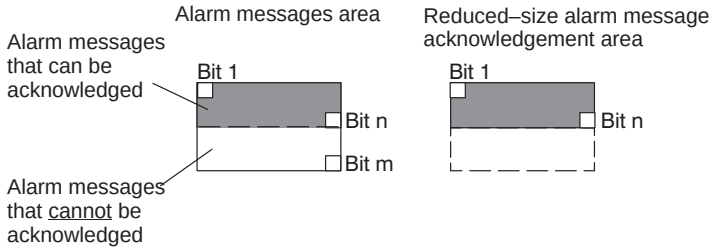


Figure 13-6 Reduced–size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 1 in ascending order.

13.3 LED Assignment

Application

The Operator Panel (OP) and Multi Panel (MP) have function keys with Light–Emitting Diodes (LEDs) integrated in them. These LEDs can be controlled from the PLC. This means, for example, that in specific situations, it is possible to indicate to the operator which key should be pressed by switching on an LED.

Condition

In order to control LEDs, corresponding data areas, so-called LED assignments, must be set up in the PLC and defined in the configuration as *area pointers*.

Data areas

The LED assignment can be divided into separate data areas, as illustrated in the following table.

Data areas	OP37/Pro	MP270
Max. number	8	8
Overall length of all data areas (words)	16	16

LED assignment

The assignment of the individual LEDs to the bits in the data areas is defined when the function keys are configured. This involves specifying a bit number within the assignment area for each LED.

The bit number (n) identifies the first of two consecutive bits that control a total of four different LED statuses (see Table 13-4):

Table 13-4 LED flashing frequency

Bit n + 1	Bit n	LED function
0	0	Off
0	1	Flashes
1	0	Flashes
1	1	Permanently on

13.4 Trend Request and Transfer Areas

Trends

A trend is the graphical representation of a value from the PLC. Reading of the value can be time-triggered or bit-triggered, depending on the configuration.

Time-triggered trends

The operating unit reads in the trend values cyclically, according to the time interval defined in the configuration. Time-triggered trends are suitable for continuous progressions such as the operating temperature of a motor.

Bit-triggered trends

By setting a trigger bit, the operating unit reads in either a trend value or the entire trend buffer. This is specified in the configuration. Bit-triggered trends are normally used to display values of an area subject to rapid variation. An example of this is the injection pressure for plastic mouldings.

In order to be able to activate bit-triggered trends, corresponding data areas have to be specified in the configuration (under *Area Pointers*) and set up on the PLC. The operating unit and the PLC communicate with one another via those areas.

The following areas are available for trends:
- Trend request area
- Trend transfer area 1
- Trend transfer area 2 (required with switch buffer only)

Assign a trend to a bit in the configuration. This ensures the bit assignment is unique for all areas.

Switch buffer

The switch buffer is a second buffer for the same trend and can be set up during the configuration.

While the operating unit reads the value from Buffer 1, the PLC writes it in Buffer 2. If the operating unit reads from Buffer 2, the PLC writes to Buffer 1. This prevents the trend value being overwritten by the PLC when being read by the operating unit.

Data area division

The individual areas, namely trend request area and trend transfer areas 1 and 2, can be divided into separate data areas with a predefined maximum number and length (Table 13-5).

Table 13-5 Division of data areas

	Data areas		
	Request	Transfer	
		1	2
Max. number per type	8	8	8
Overall length of all data areas (words)	8	8	8

Trend request area

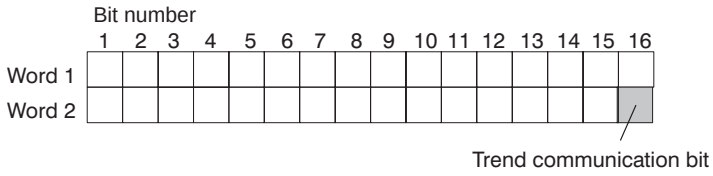
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

The trend request area can be used by the PLC to ascertain which trend is currently being displayed on the operating unit. Trends can also be triggered without analysis of the trend request area.

Trend transfer area 1

This area serves to trigger trends. In the PLC program, set the bit assigned to the trend in the trend transfer area and the trend communication bit. The operating unit detects triggering and reads in either a trend value or the entire buffer, according to the configuration. It then resets the trend bit and the trend communication bit.

Trend transfer area(s)



The trend transfer area must not be altered by the PLC program until the trend communication bit has been reset.

Trend transfer area 2

Trend transfer area 2 is necessary for trends that are configured with a switch buffer. Its layout is precisely the same as that of trend transfer area 1.

13.5 Screen Number Area

Application

The operating units store information concerning the screen currently open on the unit in the screen number area.

This enables the transfer of data regarding the current operating unit display content to the PLC which, in turn, can trigger certain reactions; e.g. call in a different screen.

Condition

If the screen number area should be used, it must be specified in the configuration as an *Area Pointer*. It can only be stored in one PLC and only once.

The screen number area is downloaded to the PLC spontaneously, i.e. the transfer is always initiated when a change is registered on the operating unit. Therefore, it is not necessary to configure a polling time.

Structure

The screen number area is a data area with a fixed length of data words.

The structure of the screen number area in the PLC memory is illustrated below.

	1	16
Word 1	Current screen type	
Word 2	Current screen number	
Word 3	Reserved	
Word 4	Reserved	
Word 5	Reserved	

Entry	Assignment
Current screen type	1
Current screen number	1 to 65535

13.6 Using PLC Jobs

Description

PLC jobs can be used to initiate functions on the operating unit from the PLC. These functions include:

- Displaying screens
- Setting date and time

A PLC job is identified by its job number. Depending on the PLC job in question, up to three parameters can then be specified.

Job mailbox

The job mailbox can be used to send PLC jobs to the operating unit, thus initiating actions on the operating unit.

The job mailbox is set up under *Area pointer* and has a length of four data words.

Word	1	16
n+0	Job no.	
	Parameter 1	
	Parameter 2	
n+3	Parameter 3	

The first word of the job mailbox contains the job number. The parameters of the job must be entered in the succeeding words (maximum of 3).

If the first word of the job mailbox is not equal to zero, the operating unit analyzes the PLC job. The operating unit then sets this data word to zero again. For this reason, the parameters must be entered in the job mailbox first and then the job number.

The PLC jobs possible are listed in the Appendix B together with their job numbers and parameters.

13.7 Coordination Area

The coordination area is two data words long. It serves to realize the following functions:

- Detection of operating unit startup by the PLC program,
- Detection of the current operating unit operating mode by the PLC program,
- Detection by the PLC program that the operating unit is ready to communicate.

Note

Each time the coordination area is updated by the operating unit, the entire coordination area is written.

Therefore, the PLC program must not execute any modifications in the coordination area.

In order to use the coordination area, both data words must be specified, whereby the first data word is used. The second data word is reserved. Figure 13-7 illustrates the structure of the first first data word.

Bit assignment in coordination area

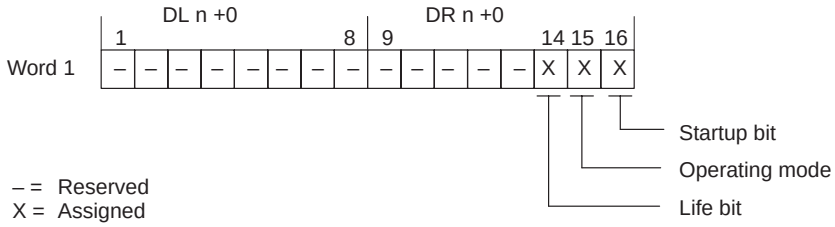


Figure 13-7 Significance of the bits in the coordination area

Startup bit

The startup bit is set to 0 for a short time during the start-up routine by the operating unit. After the startup routine has been completed, the bit is set permanently to 1.

Operating mode

As soon as the operating unit has been switched offline by the operator, the operating mode bit is set to 1. When the operating unit is working in normal operation, the operating mode bit is set to 0. The PLC program can be used to poll this bit and thus establish the current operating mode of the operating unit.

Life bit

The life bit is inverted by the operating unit at intervals of one second. The PLC program can be used to poll this bit to check whether connection to the operating unit still exists.

13.8 Transferring Date and Time to the PLC

Transferring date and time

Transfer of date and time from the operating unit to the PLC can be triggered by PLC job 41. PLC job 41 writes the date and time to the data area Date/ Time where they can be analyzed by the PLC program. Figure 13-8 illustrates the structure of the data area. All data is in BCD format.

	DL	DR	
DW	1 8	9 16	
n+0	Reserved	Hour (0...23)	Time
n+1	Minute (0...59)	Second (0 – 59)	
n+2	Reserved		
n+3	Reserved	Weekday (1...7, 1=Sun)	Date
n+4	Day (1...31)	Month (1 – 12)	
n+5	Year (0...99)	Reserved	

Figure 13-8 Structure of data area **Time** and **Date**

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Communication Management for Allen-Bradley SLC 500 / PLC-5

14

This chapter describes communication between the operating unit and the PLC. In the case of Allen–Bradley SLC 500 / PLC–5 PLCs, connection is made by means of the internal PLC driver. This is a point-to-point connection.

Supported operating units

The following operating units can be connected to Allen-Bradley SLC 500 / PLC–5:

- PC
- OP37/Pro
- MP270

Installation

The driver for connection to the Allen Bradley SLC 500 / PLC–5 is supplied with the configuration software and installed automatically.

Connecting the operating unit to the Allen-Bradley SLC 500 / PLC–5 primarily involves making the physical connection to the operating unit. Special function blocks for connection to the PLC are not required.

Note

The company Allen-Bradley offers a wide range of communication adapters for integration of “DF1–subscribers” for networks DH–485, DH and DH+. These connections have **not** been tested by Siemens AG and, therefore, **not** been approved for release.

Connection

The operating unit must be connected to the DF1 interface on the CPU (RS232). Please refer to Table 14-1 for information concerning the connection cable to be used.

Details regarding which interface to use on the operating unit are provided in the relevant equipment manual.

Table 14-1 Applicable connection cables

	SLC 500	PLC–5	
	RS232, 9–pin	RS232, 25–pin	RS422, 25–pin
All operating units (except PC) RS232, 15–pin	6VX1 440–2K_ _ _	6XV1 440–2L_ _ _	–
All operating units (except PC) RS422, 9–pin	–	–	6XV1 440–2V_ _ _
PC (COM1, COM2)	Allen-Bradley standard cable 1747 CP3	Allen-Bradley standard cable 1747 CP10	–

'_' = Length code

Behavior of ProTool V5.1

ProTool V5.1 does not support exactly the same data formats as ProTool V5.0x for some PLCs. However, it is still possible to used your configuration. After calling in the configuration using ProTool V5.1, the configuration window item object type *Tags* displays "invalid data format". The configuration can be edited but not generated. This concerns the following PLCs:

- SIMATIC 505
- Allen-Bradley
- SIMATIC S5–DP

Modifying data formats

Call in the dialog box for the tag with a double click. The old, invalid data format is displayed. Change the data format to a valid one.

14.1 Basic Methods of Functioning

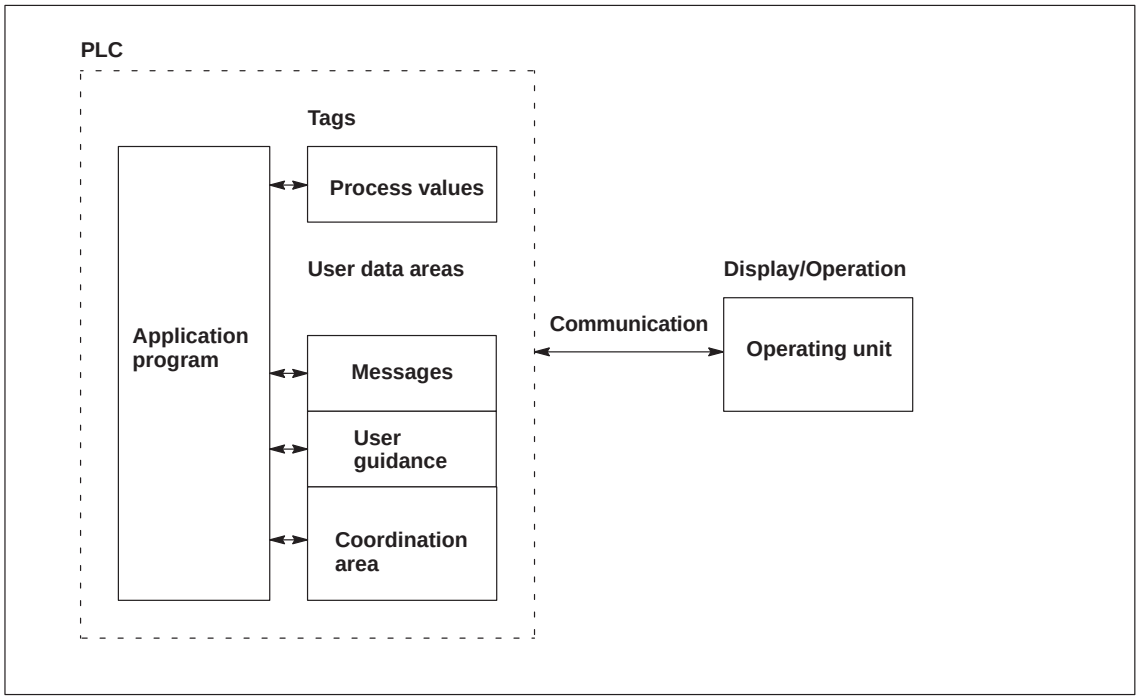


Figure 14-1 Communication structure

Task of the tags

The general data exchanged between Allen-Bradley SLC 500 / PLC–5 and operating unit is performed by means of process values. To do this, tags are created in the configuration which point to an address in the Allen-Bradley SLC 500 / PLC–5. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit which is then written to the address in the Allen-Bradley SLC 500 / PLC–5.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data areas are required for:
- Messages,
- Trends,
- PLC jobs,
- Controlling LEDs,
- Life bit monitoring.

A detailed description of the user data areas is provided in Chapter 15.

14.2 Configuring Allen-Bradley SLC 500 / PLC–5

When creating a new project, the project assistant requests the definition of the PLC. First of all, select the protocol ALLEN–BRADLEY DF1 SLC500 or ALLEN–BRADLEY DF1 PLC–5 and then define the following parameters after clicking on the button *Parameter.* For any subsequent parameter modifications, select the item *PLC* in the project window.

Define the following parameters for the PLC:

Table 14-2 PLC parameters

Parameter	Explanation
Interface	Define the operating unit interface which is connected to the Allen-Bradley SLC 500 / PLC–5. When using a PC, this can be COM1 or COM2. In the case of OP37/Pro and MP270, this can be interface IF1A or IF1B, depending on the physics implemented. Also, in the case of the OP37/Pro, the interface actually used must be set in the BIOS. If the interface IF1A is used with RS232, no modification is necessary. If the interface IF1B is used with RS422, select the mask *Integrated Peripherals* in the BIOS. Select the entry *Serial 1* and set the physics to RS422/RS485 (IF1B).
Interface type	Select either RS232 or RS422.
Data bits	Set 8 here.
Parity	Set NONE or EVEN here.
Stop bits	Set 1 or 2 here.
Baud rate	The transmission rate from the operating unit and Allen-Bradley SLC 500 / PLC–5 is set here. The communication can be set to a baud rate of 19200, 9600, 4800, 2400, 1200, 600 or 300 baud.

Note

BCC is used for troubleshooting with Allen-Bradley SLC 500 / PLC–5. To do this, set the PLC SLC 500 Configuration Channel 0 to operating mode SYSTEM. Configure the driver DF1 FULL–DUPLEX as follows:

– NO HANDSHAKING in Control Line and
– AUTO–DETECT in Embedded Responses.

14.3 Supported Data Types

When configuring tags and area pointers, the data types listed in Table 14-3 are available for use.

Table 14-3 Data types available

Data type	Addressed by	Format
ASCII	A	ASCII
Binary	B	BIT, UNSIGNED INT
Counter	C	BIT, SIGNED INT, UNSIGNED INT
BCD (only PLC–5)	D	BIT, SIGNED INT, UNSIGNED INT, BCD4, BCD8
Float	F	REAL
Digital Input	I	BIT, UNSIGNED INT
Data Register (Integer)	N	BIT, SIGNED INT, UNSIGNED INT, SIGNED LONG, UNSIGNED LONG, REAL
Digital Output	O	BIT, UNSIGNED INT
Control	R	BIT, UNSIGNED INT
Status	S	BIT, UNSIGNED INT
Timer	T	BIT, SIGNED INT, UNSIGNED INT

Display in ProTool/Pro

In ProTool/Pro the data format UNSIGNED INT is abbreviated as UINT, UNSIGNED LONG as ULONG, SIGNED INT as INT and SIGNED LONG as LONG.

Note

Input/output modules with 8 or 16 ports occupy a complete word in the PLC. An input/output module with 24 or 32 ports occupies two words. If non–available bits are assigned in the operating unit, the unit issues an error message. For this reason, ensure during configuration of input/output modules with 8 or 24 ports that only those bits are assigned which are assigned to a port.

14.4 Optimization

Acquisition cycle and update times

The acquisition cycles defined in the configuration software for the *area pointer* for the tags are major factors in respect of the real update times which are achieved. The update time is the acquisition cycle plus transmission time plus processing time.

In order to achieve optimum update times, the following points should be observed during configuration:

- When setting up the individual data areas, make them as large as necessary but as small as possible.
- Define data areas that belong together as contiguous areas. The effective update time is improved by setting one single large area rather than several smaller areas.
- Setting acquisition cycles which are too short unnecessarily impairs overall performance. Set the acquisition cycle to correspond to the modification time of the process values. The rate of change of temperature of a furnace, for example, is considerably slower than the acceleration curve of an electric motor.

  Guideline value for the acquisition cycle: Approx. 1 second.
- If necessary, dispense with cyclic transmission of user data areas (acquisition cycle = 0) in order to improve the update time. Instead, use PLC jobs to transfer the user data areas at random times.
- Store the tags for a message or a screen in a contiguous data area.
- In order that changes on the PLC are reliably detected by the operating unit, they must occur during the actual acquisition cycle at least.

Screens

In the case of screens, the real update time which can be achieved is dependent on:

- the number of data areas used,
- the type and volume of data to be displayed,
- the distribution of data within a particular data area.

In the interests of achieving rapid update times, the following points should be observed during configuration:

- Use only one data block for the tags of a particular screen.
- Store the items of data to be used as closely as possible to one another in the DB.
- Only configure short acquisition cycles for those objects which actually need to be updated quickly.

Trends

If, in the case of bit-triggered trends, the communication bit is set in the *trend transfer area*, the operating unit always updates all the trends whose bit is set in that area. It resets the bit afterwards. If the PLC program immediately sets the bit again, the OP spends all its time updating the trends. It is then virtually impossible to operate the operating unit.

PLC jobs

If large numbers of PLC jobs are sent to the operating unit in quick succession, communication between the operating unit and PLC may become overloaded.

If the operating unit enters the value 0 in the first data word of the job mailbox, it signifies that the operating unit has accepted the job. It then processes the job, for which it requires a certain amount of time. If a new PLC job is then immediately entered in the job mailbox, it may take some time before the operating unit executes the next PLC job. The next PLC job is only accepted when sufficient computer performance is available.

User Data Areas for Allen-Bradley SLC 500 / PLC–5

15

User data areas are used for data exchange between the PLC and operating unit.

These data areas are written to and read by the operating unit and the application program alternately during the process of communication. By analyzing the data stored there, the PLC and operating unit reciprocally initiate predefined actions.

This chapter describes the function, layout and special features of the various user data areas.

15.1 Overview

Definition

User data areas can be located in data blocks and memory areas in the PLC. User data areas include messages and trends. Set up user data areas both in the configuration, using menu item *System→ Area Pointer* and in the PLC.

Function range

The user data areas available depend on the operating unit used. Table 15-1 summarizes the range of functions available on the individual operating units.

Table 15-1 Applicable user data areas

User data area	PC	OP37/Pro	MP270
Event messages	X	X	X
Alarm messages	X	X	X
Aknowledgement area	X	X	X
LED assignment	–	X	X
Trend request area	X	X	X
Trend transfer areas	X	X	X
Screen number	X	X	X
PLC jobs	X	X	X
Coordination area	X	X	X
Date and time	X	X	X

Table 15-2 indicates who is reading (**R**) and who is writing (**W**) in respect of access to the individual data areas.

Table 15-2 Use of data areas

Data area	Necessary for	Operating unit	PLC
Event messages	Configured event messages	R	W
Alarm messages	Configured alarm messages	R	W
PLC acknowledge-ment	Alarm message acknowledge-ment from the PLC	R	W
Operating unit acknowledgement	Message from the operating unit to the PLC indicating an alarm message has been acknowledged	W	R
LED assignment (for OP and MP only)	LED triggered by the PLC	R	W

Table 15-2 Use of data areas, continued

Data area	Necessary for	Operating unit	PLC
Trend request	Configured trends with “Triggering via bit” or configured history trends	W	R
Trend transfer 1	Configured trends with “Triggering via bit” or configured history trends	R/W	R/W
Trend transfer area 2	Configured history trend with “switch buffer”	R/W	R/W
Screen number	Evaluation by the PLC as to which screen is currently open	W	R
PLC jobs	Triggering of functions on the operating unit by PLC program	R/W	R/W
Coordination area	Operating unit status polled by the PLC program	W	R
Date and time	Transfer of date and time from the operating unit to the PLC	W	R

15.2 Event and Alarm Messages

Definition

Messages consist of a static text and/or tags. The text and tags can be defined by the user.

Messages are subdivided into event messages and alarm messages. The programmer defines the event message and alarm message.

Event message

An event message indicates a status, e.g.

- `Motor switched on`
- `PLC in manual mode`

Alarm message

An alarm message indicates an operational fault, e.g.

- `Valve not opening`
- `Motor temperature too high`

Acknowledgement

Since alarm messages indicate an abnormal operational status, they must be acknowledged. They can be acknowledged either by

- operator input on the operating unit
- setting a bit in the PLC acknowledgement area.

Triggering messages

A message is triggered by setting a bit in one of the message areas on the PLC. The location of the message areas is defined by means of the configuration software. The corresponding area must also be set up in the PLC.

As soon as the bit in the PLC event/alarm message area has been set and that area has been transferred to the operating unit, the operating unit detects that the relevant message has “arrived”.

Conversely, when the same bit is reset on the PLC by the operating unit, the message is registered as having “departed”.

Message areas

Table 15-3 indicates the number of message areas for event and alarm messages, the number of alarm message acknowledgement areas (PLC → Operating Unit and Operating Unit → PLC) and the total length of the respective areas for the various operating units.

Table 15-3 Operating unit message areas

Unit	**Event message area**		**Alarm messages area/ Alarm message area**	
	Number	**Length** (words)	**Number per type**	**Overall length per type** (words)
PC	8	125	8	125
OP37/Pro	8	125	8	125
MP270	8	125	8	125

The length of a contiguous area may not exceed 64 words.

Assignment of message bit and message number

A message can be configured for each bit in the message area. The bits are assigned to the message numbers in ascending order.

Example:

The following event messages are configured for the PLC Allen-Bradley SLC 500 / PLC-5:

```
N7          Element 8   Length 5 words
```

Figure 15-1 shows the assignment of all 80 (5 x 16) message numbers to the individual bit numbers in the PLC event message area.

The assignment is performed automatically on the operating unit.

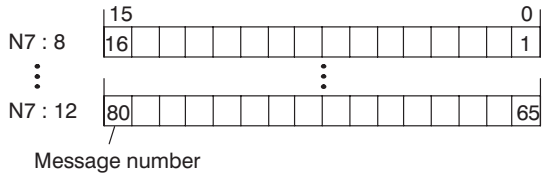


Figure 15-1 Assignment of message bit and message number

Acknowledgement areas

If the PLC should be informed of an alarm message acknowledgement on the operating unit or the acknowledgement should be initiated on the PLC itself, the relevant acknowledgement areas must also be specified in the configuration. These acknowledgement areas must also be specified in the configuration.

- **Acknowledgement area Operating Unit → PLC**:
  This area is used to inform the PLC when an alarm message has been acknowledged by means of operator input on the operating unit. In this case, the area pointer “OP acknowledgement” must be set.
- **Acknowledgement area PLC → Operating Unit**:
  This area is used when an alarm message is acknowledged by the PLC. In this case, the area pointer “PLC acknowledgement” must be set.

These acknowledgement areas must also be specified in the configuration under *Area Pointers*.

Figure 15-2 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 15-4 and 15-5.

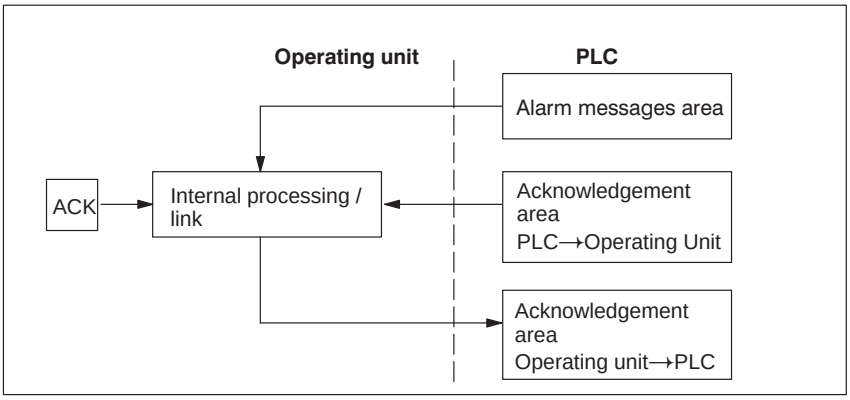


Figure 15-2 Alarm message and acknowledgement areas

Assignment of acknowledgement bit to message number

Each alarm message is assigned a message number. The message number is assigned the same bit number in the alarm messages area as that assigned in the acknowledgement area. Under normal circumstances, the acknowledgement area is the same length as the associated alarm messages area.

If the length of an acknowledgement area is not equal to the overall length of the associated alarm messages area, and there are succeeding alarm messages and acknowledgement areas, the following assignment applies:

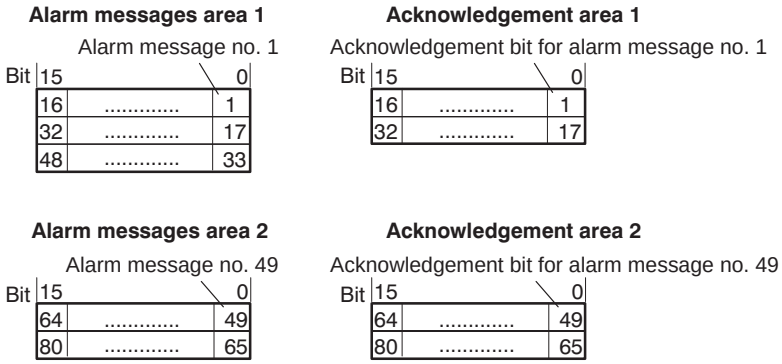


Figure 15-3 Assignment of acknowledgement bit and message number

Acknowledgement area PLC → Operating Unit

A bit set in this area by the PLC initiates the acknowledgement of the corresponding alarm message in the operating unit, thus fulfilling the same function as pressing the "ACK" key. Reset the bit before setting the bit in the alarm message area again. Figure 15-4 shows the signal diagram.

The acknowledgement area PLC → Operating Unit

- must follow on immediately from the associated alarm messages area,
- must have precisely the same polling time and
- may not be any longer than the associated alarm messages area.

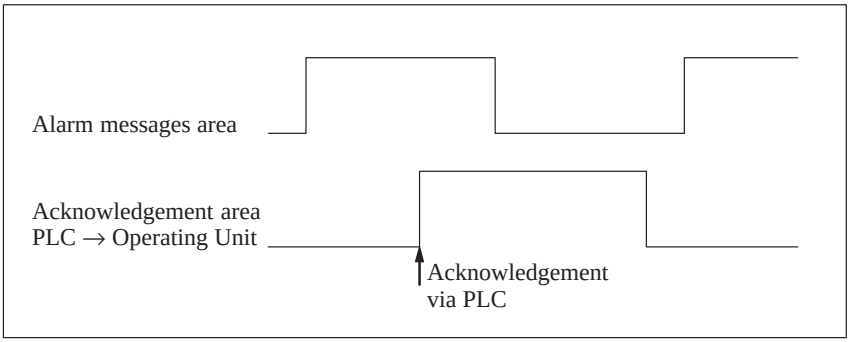


Figure 15-4 Signal diagram for acknowledgement area PLC → Operating Unit

Acknowledgement area Operating Unit → PLC

When a bit is set in the alarm message area, the operating unit resets the associated bit in the acknowledgement area. As a result of the processing via the operating unit, the two processes indicate a slight difference with regard to time. If the alarm message is acknowledged on the operating unit, the bit in the acknowledgement area is set. In this way, the PLC can detect that the alarm message has been acknowledged. Figure 15-5 shows the signal diagram.

The acknowledgement area Operating Unit → PLC must be no longer than the associated alarm messages area.

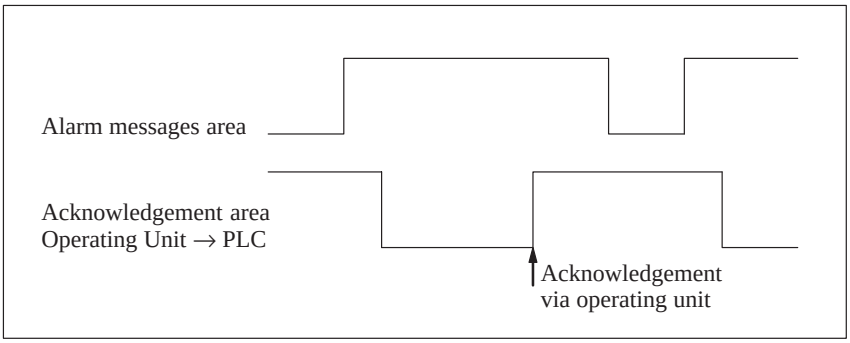


Figure 15-5 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area size

The acknowledgement areas PLC → Operating Unit and Operating Unit → PLC must not be any longer than the associated alarm message areas. They can, however, be smaller if acknowledgement by the PLC is not required for all alarm messages. This is also valid when the acknowledgement need not be detected in the PLC for all alarm messages. Figure 15-6 illustrates such a case.

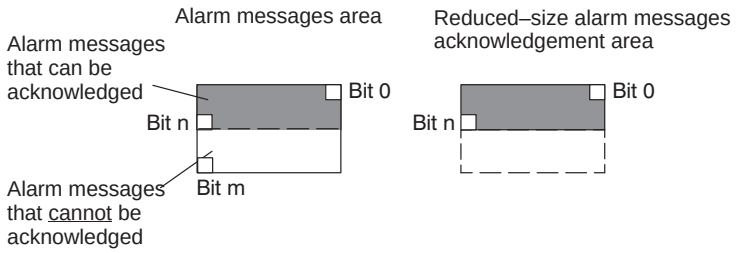


Figure 15-6 Reduced–size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 0 in ascending order.

15.3 LED Assignment

Application

The Operator Panel (OP) and Multi Panel (MP) have function keys with Light–Emitting Diodes (LEDs) integrated in them. These LEDs can be controlled from the PLC. This means, for example, that in specific situations, it is possible to indicate to the operator which key should be pressed by switching on an LED.

Condition

In order to control LEDs, corresponding data areas, so-called LED assignments, must be set up in the PLC and defined in the configuration as *area pointers*.

Data areas

The LED assignment can be divided into separate data areas, as illustrated in the following table.

Data areas	OP37/Pro	MP270
Max. number	8	8
Overall length of all data areas (words)	16	16

LED assignment

The assignment of the individual LEDs to the bits in the data areas is defined when the function keys are configured. This involves specifying a bit number within the assignment area for each LED.

The bit number (n) identifies the first of two consecutive bits that control a total of four different LED statuses (see Table 15-4):

Table 15-4 LED flashing frequency

Bit n + 1	Bit n	LED function
0	0	Off
0	1	Flashes
1	0	Flashes
1	1	Permanently on

15.4 Trend Request and Transfer Areas

Trends

A trend is the graphical representation of a value from the PLC. Reading of the value can be time-triggered or bit-triggered, depending on the configuration.

Time-triggered trends

The operating unit reads in the trend values cyclically, according to the time interval defined in the configuration. Time-triggered trends are suitable for continuous progressions such as the operating temperature of a motor.

Bit-triggered trends

By setting a trigger bit, the operating unit reads in either a trend value or the entire trend buffer. This is specified in the configuration. Bit-triggered trends are normally used to display values of an area subject to rapid variation. An example of this is the injection pressure for plastic mouldings.

In order to be able to activate bit-triggered trends, corresponding data areas have to be specified in the configuration (under *Area Pointers*) and set up on the PLC. The operating unit and the PLC communicate with one another via those areas.

The following areas are available for trends:
– Trend request area
– Trend transfer area 1
– Trend transfer area 2 (required with switch buffer only)

Assign a trend to a bit in the configuration. This ensures the bit assignment is unique for all areas.

Switch buffer

The switch buffer is a second buffer for the same trend and can be set up during the configuration.

While the operating unit reads the value from Buffer 1, the PLC writes it in Buffer 2. If the operating unit reads from Buffer 2, the PLC writes to Buffer 1. This prevents the trend value being overwritten by the PLC when being read by the operating unit.

Data area division

The individual areas, namely trend request area and trend transfer areas 1 and 2, can be divided into separate data areas with a predefined maximum number and length (Table 15-5).

Table 15-5 Division of data areas

	Data areas		
	Request	Transfer	
		1	2
Max. number per type	8	8	8
Overall length of all data areas (words)	8	8	8

Trend request area

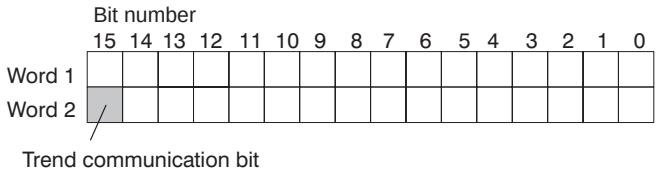
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

The trend request area can be used by the PLC to ascertain which trend is currently being displayed on the operating unit. Trends can also be triggered without analysis of the trend request area.

Trend transfer area 1

This area serves to trigger trends. In the PLC program, set the bit assigned to the trend in the trend transfer area and the trend communication bit. The operating unit detects triggering and reads in either a trend value or the entire buffer, according to the configuration. It then resets resets the trend bit and the trend communication bit .

Trend transfer area(s)



The trend transfer area must not be altered by the PLC program until the trend communication bit has been reset.

Trend transfer area 2

Trend transfer area 2 is necessary for trends that are configured with a switch buffer. Its layout is precisely the same as that of trend transfer area 1.

15.5 Screen Number Area

Application

The operating units store information concerning the screen currently open on the unit in the screen number area.

This enables the transfer of data regarding the current operating unit display content to the PLC which, in turn, can trigger certain reactions; e.g. call in a different screen.

Condition

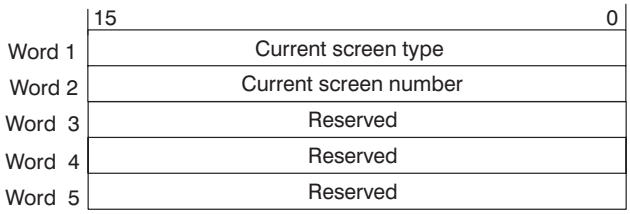
If the screen number area should be used, it must be specified in the configuration as an *Area Pointer*. It can only be stored in one PLC and only once.

The screen number area is downloaded to the PLC spontaneously, i.e. the transfer is always initiated when a change is registered on the operating unit. Therefore, it is not necessary to configure a polling time.

Structure

The screen number area is a data area with a fixed length of data words.

The structure of the screen number area in the PLC memory is illustrated below.



Entry	Assignment
Current screen type	1
Current screen number	1 to 65535

15.6 Using PLC Jobs

Description

PLC jobs can be used to initiate functions on the operating unit from the PLC. These functions include:

- Displaying screens
- Setting date and time

A PLC job is identified by its job number. Depending on the PLC job in question, up to three parameters can then be specified.

Job mailbox

The job mailbox can be used to send PLC jobs to the operating unit, thus initiating actions on the operating unit.

The job mailbox is set up under *Area Pointer* and has a length of four data words.

The first word of the job mailbox contains the job number. The parameters of the job must be entered in the succeeding words (maximum of 3).

Word	15 … 0
n+0	Job no.
	Parameter 1
	Parameter 2
n+3	Parameter 3

If the first word of the job mailbox is not equal to zero, the operating unit analyzes the PLC job. Afterwards, the unit sets this data word to zero again. For this reason, the parameters must be entered in the job mailbox first and then the job number.

The PLC jobs possible are listed in the Appendix B together with their job numbers and parameters.

15.7 Coordination Area

The coordination area is two data words long. It serves to realize the following functions:

- Detection of operating unit startup by the PLC program,
- Detection of the current operating unit operating mode by the PLC program,
- Detection by the PLC program that the operating unit is ready to communicate.

Note

Each time the coordination area is updated by the operating unit, the entire coordination area is written.

Therefore, the PLC program must not execute any modifications in the coordination area.

In order to use the coordination area, both words must be specified but only the first word is actually used. The second word is reserved.
Figure 15-7 illustrates the structure of Word 1.

Bit assignment in coordination area

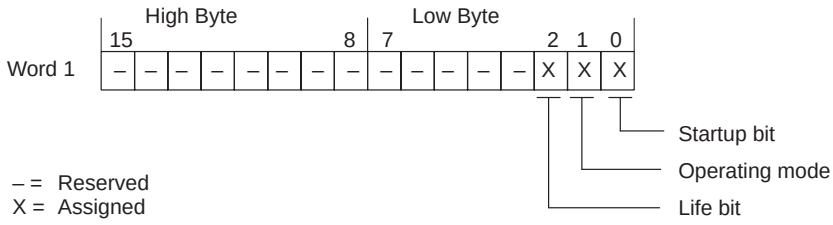


Figure 15-7 Significance of the bits in the coordination area

Startup bit

The startup bit is set to 0 for a short time during the start–up routine by the operating unit. After the startup routine has been completed, the bit is set permanently to 1.

Operating mode

As soon as the operating unit has been switched offline by the operator, the operating mode bit is set to 1. When the operating unit is working in normal operation, the operating mode bit is set to 0. The PLC program can be used to poll this bit and thus establish the current operating mode of the operating unit.

Life bit

The life bit is inverted by the operating unit at intervals of one second. The PLC program can be used to poll this bit to check whether connection to the operating unit still exists.

15.8 Transferring Date and Time to the PLC

Transferring date and time

Transfer of date and time from the operating unit to the PLC can be triggered by PLC job 41. PLC job 41 writes the date and time to the data area Date/ Time where they can be analyzed by the PLC program. Figure 15-8 illustrates the structure of the data area. All data is in BCD format.

	High Byte	Low Byte	
Word	15 8	7 0	
n+0	Reserved	Hour (0...23)	Time
n+1	Minute (0...59)	Second (0 – 59)	
n+2	Reserved		
n+3	Reserved	Weekday (1...7, 1=Sun)	Date
n+4	Day (1...31)	Month (1 – 12)	
n+5	Year (0...99)	Reserved	

Figure 15-8 Structure of data area **Time** and **Date**

Part VII Appendix

System Messages A

PLC Jobs B

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System Messages

A

A.1 Operating Unit System Messages

Message number

Operating unit system messages can be divided into various categories.

The information concerning the category to which a system message belongs is included in the message number:

01 Printer
02 Scripts
03 Scale
06 Win32 functions
07 Win32 functions
08 Archives
11 Offline function
12 Trends
13 System information
14 Channels and connections: S7
15 Channels and connections: AS511
17 S7 diagnostics
18 Miscellaneous
19 Tags and area pointers
20 PLC coordination
21 PLC jobs
22 PLC channels
23 Views
24 Authorization
25 Status / Control
26 Passwords
27 Messages
28 PLC connection

The message category enables the identification of a general area in which the cause of the fault is to be found.

A table is provided below containing a selection of system messages, when they occur and, where possible, how the cause of the error can be eliminated.

Note

System messages are displayed in the language selected in the configuration.

Procedure in the case of "internal errors"

Adopt the following procedure for all system messages referring to "internal errors":

a) Switch the operating unit off, set the PLC to the STOP status and then start up both units again.

b) Download the configuration again and then restart the PLC and operating unit.|

c) If the fault occurs again, please contact your nearest Siemens representative. When doing so, please quote the number of the error that has occurred and any tags referred to in the message.

System message parameters

The system messages may contain parameters which are not decoded for the user but which are relevant in respect of the cause of an error since they provide a reference to the source code from ProTool/Pro Runtime. These parameters are issued according to the text "Error code:".

Number	Effect/Cause	Remedy
10000	The print job could not be started or was terminated for an unknown reason. The printer is incorrectly configured. Or: There are no rights for a network printer available.	Configure the printer again. Initiate the assignment of rights for a network printer.
10001	No printer has been installed or no standard printer configured.	Install a printer and/or mark one as standard printer.
10002	The intermediate buffer for printing graphics is full. Up to two graphics can be buffered.	Do not issue print jobs so quickly in succession.
10003	Graphics can be buffered again.	–
10004	The intermediate buffer for printing lines in text mode (e.g. messages) is full. Up to 1000 lines can be buffered.	Do not issue print jobs so quickly in succession.
10005	Lines of text can be buffered again.	–
20010	A fault has occurred in the script line specified. Execution of the script function was, therefore, terminated. In this case, it is advisable to check any previous system messages too.	Select the specified script line in the configuration. Check Tags, whether the types used are permissible. Check Functions, whether the number and types of parameter are correct.

Number	Effect/Cause	Remedy
20011	An error has occurred in a script called in by the script specified. Execution of the script function has, therefore, been terminated in the subscript. In this case, it is advisable to check any previous system messages too.	Select the scripts from the configuration which were directly or indirectly called in via the specified script. Check Tags, whether the types used are permissible. Check Functions, whether the number and types of parameter are correct.
20012	Inconsistent configuration data is present. Therefore, the script could not be created.	Compile the configuration again.
20013	VBScript.dll is not correctly installed. Therefore, no scripts can be executed.	Re-install ProTool/Pro RT.
20014	A value is returned by the script function which is not written in any configured return tag.	Select the specified script in the configuration. Check whether the script name has been assigned a value.
20015	Too many scripts have been triggered in quick succession. If more than 20 scripts are queued to be processed, any subsequent scripts are rejected. In this case, the script indicated in the message is not executed.	Check where the scripts are being triggered from. Extend the times, e.g. the polling time of the tags, which trigger the scripts.
30010	The tag could not accept the function result, e.g. in the case of exceeding the value range.	Check the tag type of the function parameter.
30011	A function could not be executed because the function was assigned an invalid value or type in the parameter.	Check the parameter value and tag type of the invalid parameter. If a tag is used as a parameter, check its value.
40010	The function could not be executed since the parameters could not be converted to a common tag type.	Check the parameter types in the configuration.
40011	The function could not be executed since the parameters could not be converted to a common tag type.	Check the parameter types in the configuration.
50000	The operating unit receives data faster than it is capable of processing. Therfore, no further data is received until the data currently available has been processed. Data exchange then resumes.	–
50001	Data exchange has been resumed.	–
60000	This message is generated by the function “Display system messages”. The text to be displayed is transferred to the function as a parameter.	–
60010	The file could not be copied in the direction defined because either one of the two files is currently open or the source/target path is not available. It is possible that the Windows NT user has no access rights to one of the two files.	Restart the function or check the paths of the source/target files. Using Windows NT with NTFS: The user executing ProTool/Pro RT must be granted access rights for the files.

Number	Effect/Cause	Remedy
60011	An attempt was made to copy a file to itself. It is possible that the Windows NT user has no access rights to one of the two file.	Check the path of the source-/target file. Using Windows NT with NTFS: The user executing ProTool/Pro RT must be granted access rights for the files.
70010	The application could not be started because it could not be found in the path specified or insufficient memory space was available.	Check whether the application exists in the specified path or close other applications.
70011	The system time could not be modified This may be due to the following: – an impermissible time was transferred in the PLC job, – the Windows NT user has no user rights to modify the system time.	Check the time which is to be set. Under Windows NT: The user executing ProTool/Pro RT must be assigned the rights to modify the system time from Windows NT (administration/ user manager, guidelines).
70012	An error occurred when executing the function “Exit Runtime” with the option “Exit also Windows”. Windows and ProTool/Pro RT are not terminated. A possible cause is that other applications cannot be terminated.	Terminate all applications currently running. Then terminate Windows.
70013	The system time could not be modified because an invalid value was entered. Incorrect separators may have been used.	Check the time which is to be set.
70014	The system time could not be modified This may be due to the following: – an impermissible time was transferred – the Windows NT user has no user rights to modify the system time, – Windows rejects the setting request.	Check the time which is to be set. Under Windows NT: The user executing ProTool/Pro RT must be assigned the rights to modify the system time from Windows NT (administration/ user manager, guidelines).
70015	The system time could not be read because Windows rejects the reading function.	–
70016	An attempt was made to select a screen by means of a function or job. This is not possible because the screen number specified does not exist. Or: a screen could not be generated due to insufficient system memory.	Check the screen number in the function or job with the screen numbers configured. Refer the number to a screen, if necessary.
80001	–	Store the file or table by executing a ‘move’ or ‘copy’ function.
80002	A line is missing in the specified archive.	–
80003	The copying process for archiving was not successful. In this case, it is advisable to check any subsequent system messages, too.	–
80005	The copying process for archiving was not successful. If an automatic trigger is used for archiving, data may have been lost.	–

Number	Effect/Cause	Remedy
80006	Since archiving is not possible, this causes a permanent loss of the functionality.	In the case of databases, check whether the corresponding data source exists and start up the system again.
80008	Since archiving is not possible, this causes a permanent loss of the functionality.	Restart the system when the full functionality is required.
80010	Since the path was incorrectly entered in ProTool, this causes a permanent loss of the functionality.	Configure the path for the respective archive again and restart the system when the full functionality is required.
80011	Target archives are open.	You have two minutes in which to close the target archive, then a new attempt is made.
80012	Archive values are stored in a buffer. If the values are read to the buffer faster than they can be physically written (e.g. using a hard disk), overloading may occur and recording is then stopped.	Archive less values. Or increase the recording interval.
80013	The overload status no longer applies. Archiving resumes the recording of all values.	–
80014	The same action was triggered twice in quick succession. Since the process is already in operation, the action is only carried out once.	–
110000	The operating mode status has been changed. The operating mode is now offline.	–
110001	The operating mode status has been changed. The operating mode is now online.	–
110002	The operating mode status has not been changed.	Check the connection to the PLCs. Check whether the address area for the area pointer “Coordination” in the PLC is available.
120000	The trend is not displayed because an incorrect axis to the trend, or incorrect trend, has been configured.	Change the configuration.
120001	The trend is not displayed because an incorrect axis to the trend, or incorrect trend, has been configured.	Change the configuration.
120002	The trend is not displayed because the tag assigned tries to access an invalid PLC address.	Check whether the data area for the tag exists in the PLC, the configured address is correct or the value range for the tag is correct.
130000	The action was not executed.	Close other applications. Delete files no longer required from the hard disk.
130001	The action was not executed.	Delete files no longer required from the hard disk.
130002	The action was not executed.	Close other applications. Delete files no longer required from the hard disk.
140000	Online connection to the PLC has been successfully established.	–

Number	Effect/Cause	Remedy
140001	Online connection to the PLC has been disconnected.	–
140003	No tag updating or writing is executed.	Check the connection and whether the PLC is switched on. Check the parameter definitions in the Control Panel using “Set PU/PC interface”. Restart the system.
140004	No tag updating or writing is executed because the access point or the subrack configuration is incorrect.	Check the connection and whether the PLC is switched on. Check the access point or the subrack configuration (MPI, PPI, PROFIBUS) in the Control Panel with “Set PG/PC interface”. Restart the system.
140005	No tag updating or writing is executed because the address of the operating unit is incorrect (possibly too high).	Use a different operating unit address. Check the connection and whether the PLC is switched on. Check the parameter definitions in the Control Panel using “Set PU/PC interface”. Restart the system.
140006	No tag updating or writing is executed because the baud rate is incorrect.	Select a different baud rate in ProTool/Pro (according to subrack, profile, communication peer, etc.).
140007	No tag updating or writing is executed because the bus profile is incorrect (see %1). The following parameters could not be entered in the registry: 1: Tslot 2: Tqui 3: Tset 4: MinTsdr 5: MaxTsdr 6: Trdy 7: Tid1 8: Tid2 9: Gap Factor 10: Retry Limit	Check the user defined bus profile. Check the connection and whether the PLC is switched on. Check the parameter definitions in the Control Panel using “Set PU/PC interface”. Restart the system.
140008	No tag updating or writing is executed because the configuration data is incorrect: The following parameters could not be entered in the registry: 0: General errors 1: Incorrect version 2: Profile cannot be entered in the registry. 3: Sub–network type cannot be entered in the registry. 4: Target rotation time cannot be entered in the registry. 5: Highest addresse (HSA) incorrect.	Check the connection and whether the PLC is switched on. Check the parameter definitions in the Control Panel using “Set PU/PC interface”. Restart the system.

Number	Effect/Cause	Remedy
140009	No tag updating or writing is executed because the module for the S7 communication was not found.	Re-install the module in the Control Panel using “Set PG/PC interface”.
140010	No S7 communication peer could be found because the PLC is switched off. DP/T: The option “Is not active as the only master” is set in the Control Panel under “Set PG/PC interface”.	Switch the PLC on. DP/T: If only one master is connected to the network, deactivate the option “Is not active as the only master” in “Set PG/PC interface”. If the network has more than one master, switch this master on. Do not modify any settings here, otherwise a bus fault may occur.
140011	No tag updating or writing is executed because communication is interrupted.	Check the connection and that the communication peer is switched on.
140012	There is an initialization problem (e.g. when ProTool/Pro RT has been terminated in the Task Manager). Or: another application (e.g. STEP7, WINCC) is active with different bus parameters and the driver cannot be started with the new bus parameters (e.g. baud rate).	Restart the operating unit. Or start ProTool/Pro RT first and then the other applications.
140013	The MPI cable is not plugged in and, thus, there is no power supply.	Check the connections.
140014	–	In the configuration modify the operating unit address.
140015	Incorrect baud rate Or: incorrect bus parameter (e.g. HSA) Or: OP address > HSA Or: incorrect interrupt vector (interrupt does not arrive at the driver)	Correct the incorrect parameters.
140016	–	Change the interrupt number.
140017	–	Change the interrupt number.
150000	No more data is read or written. This can have various causes: The cable is defective. The PLC does not respond, is defective, etc. Connection made to the wrong interface. The system is overloaded.	Check that the cable is plugged in, the PLC is operational, the correct interface is used. Reboot the system if the system message is displayed continuously.
150001	Connection is re-established because the cause of the interruption has been eliminated.	–
160000	No more data is read or written. This can have various causes: The cable is defective. The PLC does not respond, is defective, etc. Connection made to the wrong interfacet. The system is overloaded.	Check that the cable is plugged in, the PLC is operational, the correct interface is used. Reboot the system if the system message is displayed continuously.

Number	Effect/Cause	Remedy
160001	Connection is re-established because the cause of the interruption has been eliminated.	–
170000 1)	S7 diagnostics messages are not displayed because it is not possible to logon to the S7 diagnostics with this unit. The service program is not supported.	–
170001 1)	The S7 diagnostics buffer cannot be displayed because communication with the PLC has been switched off.	Switch the PLC online.
170002 1)	The S7 diagnostics buffer cannot be displayed because reading in the diagnostics buffer (SZL) was terminated due to an error.	–
170003 1)	The display of an S7 diagnostics message is not possible. An internal error %2 has been reported.	–
170004 1)	The display of an S7 diagnostics message is not possible. An internal error with error class %2, error number %3 has been reported.	–
170007 1)	It is not possible to read in the S7 diagnostics buffer (SZL) because it was terminated with an internal error with error class %2 and error code %3.	–
180000	A component/OCX receives configuration data with a version identification which is not supported.	Install a newer component.
190000	It is possible that the tag will not be updated.	–
190001	The tag is updated following an error status after the cause of the last error state has been eliminated (return to normal operation).	–
190002	The tag is not updated because communication to the PLC has been switched off.	Switch on communication via the function “Set Online”.
190004	The tag is not updated because the configured address is not available for this tag .	Check the configuration.
190005	The tag is not updated because the configured PLC type does not exist for this tag .	Check the configuration.
190006	The tag is not updated because it is not possible to map the PLC type in the tag type.	Check the configuration.
190007	The tag values are not modified because the connection to the PLC has been terminated or the tag is offline.	Switch online or re-establish connection to the PLC.
190008	The threshold values configured for the tag have been violated, e.g. by – an entered value, – a function, – a script.	Observe the configured or current threshold value of the tag.
190009	An attempt has been made to assign a value to a tag which is outside the value range permitted for this type. E.g. a value of 260 entered for a byte tag or a value of –3 for a signless word tag.	Observe the value range for the tag type.
190010	The tag is described with values too often (e.g. in a loop triggered by a script). Values are lost because the maximum of 100 event have been stored in the buffer.	Increase the time interval between the multi–writing tasks.

Number	Effect/Cause	Remedy
190011	There are two causes for this message: – The value entered could not be written to the configured PLC tag because it was either above or below the value range. The input is rejected and the original value is reset. – Connection to the PLC has been interrupted.	Ensure that the value entered is within the value range of the PLC tags. Check the connection to the PLC.
190012	It is not possible to convert a value from a source format to a target format, e.g.: – A value should be assigned to a counter which is outside the valid, PLC-dependent value range. – A tag of the type *Integer* should be assigned a value of the type *String*.	Check the value range or type of the variable.
190100	The area pointer is not updated because the configured address for this area pointer is not available. Type: 1 Event messages 2 Alarm messages 3 PLC acknowledgment 4 Operating unit acknowledgment 5 LED assignment 6 Trend request 7 Trend transfer 1 8 Trend transfer 2 No.: is the consecutive number displayed in ProTool/Pro.	Check the configuration.
190101	The area pointer is not updated because it is not possible to map the PLC type in the area pointer type. Parameter type and no.: See message 190100	–
190102	The area pointer is updated following an error status after the cause of the last error state has been eliminated (return to normal operation). Parameter type and no.: See message 190100	–
200000	Coordination is not executed because the address configured in the PLC does not exist/has not been set up.	Change the address or set up the address in the PLC.
200001	Coordination is not executed because the address configured in the PLC cannot be written.	Change the address or set up the address in the PLC in an area which can be written.
200002	Coordination is not executed at present because the address format of the area pointer does not match the internal storage format.	– (Internal error)
200003	Coordination can be executed again because the last error status has been eliminated (return to normal operation).	–
200004	It is possible that coordination is not executed.	–

Number	Effect/Cause	Remedy
200005	No more data is read or written. This can have various causes: – The cable is defective. – The PLC does not respond, is defective, etc. – The system is overloaded.	Check that the cable is connected and the PLC is in order. Reboot the system if the system message is displayed continuously.
210000	Jobs are not processed because the address configured in the PLC does not exist/has not been set up.	Change the address or set up the address in the PLC.
210001	Jobs are not processed because the address configured in the PLC cannot be written to/read from.	Change the address or set up the address in the PLC in an area which can be written to/read from.
210002	Jobs are not executed because the address format of the area pointer does not match the internal storage format.	(Internal error)
210003	The job mailbox is processed again because the last error status has been eliminated (return to normal operation).	–
210004	It is possible that the job mailbox is not processed.	–
210005	A PLC job was triggered by an impermissible number.	Check the PLC program.
210006	A fault occurred while attempting to execute the PLC job. The PLC job is, therefore, not executed. Observe the subsequent/previous system message, if appropriate.	Check the parameter types in the PLC job. Compile the configuration again.
220000 [2)]	See footnote	See footnote
220001	The tag is not downloaded because the associated channel/ the unit does not support downloading the data type bool/ bit.	Change the configuration.
220002	The tag is not downloaded because the associated channel/ the unit does not support downloading the data type byte.	Change the configuration.
220003	The associated driver could not be uploaded. It is possible that the driver is not installed.	Install the driver by re–installing ProTool/Pro RT.
220004	Communication is terminated and no update is executed because the cable is not connected or is defect etc.	Check the connection.
220005	Communication is running.	–
230000	The value entered could not be accepted. The entered value is rejected and the previous value is specified again. Either the value range has been exceeded or impermissible characters were entered.	Enter a permissible value.
230002	Since the current password level is inadequate or the password dialog box was closed with ESC, the entry is rejected and the previous value is specified again.	Activate an adequate password level using Login.
230003	Changeover to the specified screen is not executed because the screen is not available/configured. The current screen remains selected.	Configure the screen. Check the selection function.
240000 [3)]	Runtime is operating in Demo mode. There is either no Stopcopy license or it is defect.	Load the license.

Number	Effect/Cause	Remedy
240001 [3)]	Runtime is operating in Demo mode. Too many tags are configured for the installed version.	Load an adequate license / powerpack.
240002 [3)]	Runtime is operating with a time-limited standby authorization.	Restore the full authorization.
240003	Authorization cannot be executed. ProTool/Pro RT is running in Demo mode.	Restart ProTool/Pro RT or reinstall it.
240004	Error during reading the the standby authorization. ProTool/Pro RT is running in Demo mode.	Restart Sie ProTool/Pro RT, install the authorization or repair the authorization (see Commissioning Instructions Software Protection).
250000	The tag in the specified line in Status/Control is not updated because the address configured for this tag is not available.	Check the set address and then check that the address has been set up in the PLC.
250001	The tag in the specified line in Status/Control is not updated because the PLC type configured for this tag is not available.	Check the set address.
250002	The tag in the specified line in Status/Control is not updated because it is not possible to map the PLC type in the tag type.	Check the set address.
260001	A password has been entered which is unknown to the system. Therefore, the lowest password level has been set. This corresponds to the status following *Logout*.	Enter a known password in the password input field (with corresponding level).
260002	A password has been entered whose assigned level does not permit execution of the function. The password level currently set is displayed for information purposes.	Modify the password level in the password input field or enter a password with a sufficiently high level.
270000	A tag is not displayed in the message because it attempts to access an invalid address in the PLC.	Check whether the data area for the tag exists in the PLC, the configured address is correct or the value range for the tag is correct.
270001	There is a unit–dependent limit as to how many messages may be queued simultaneously in order to be displayed (see GHB). This limit has been exceeded. The display no longer contains all the messages. However, all the messages are recorded in the message buffer.	–
280000	Connection is re-established because the cause of the interruption has been eliminated.	–
280001	No more data is read or written. This can have various causes: The cable is defective. The PLC does not respond, is defective, etc. Connection made to the wrong interface. The system is overloaded.	Check that the cable is plugged in, the PLC is operational, the correct interface is used. Reboot the system if the system message is displayed continuously.

Number	Effect/Cause	Remedy
280002	A connection is used which requires a function module in the PLC. The function block has replied. Communication can now proceed.	–
280003	A connection is used which requires a function module in the PLC. The function block does not replied.	Check that the cable is plugged in, the PLC is operational, the correct interface is used. Reboot the system if the system message is displayed continuously. The remedy is dependent on the error code: 1: The function block must set the COM bit in the response container. 2: The function block may not set ERROR bit in the response container 3: The function block must respond within the specified time (timeout) 4: Establish an online connection to the PLC
280004	The online connection to the PLC has been interrupted. There is no data exchange at present.	Check the PLC parameters in ProTool Pro: baud rate, block length, station address. Check that the cable is plugged in, the PLC is operational, the correct interface is used. Reboot the system if the system message is displayed continuously.

1) The optional parameter %1 at the start of the message may contain an identification for the S7 connection when several S7s are in parallel operation and are connected to diagnostics equipment.
2) A WinCC channel provides the message texts via an interface. This text is issued via this message. ProTool/Pro RT has no influence on this text.
3) The specified text comes from the component resources.

A.2 Error Number of the FB DBHMI

Method of storing

The FB stores errors which have occurred in Accumulator 1 **each time** the function block is called in.

Procedure in the case of "internal errors"

Adopt the following procedure for all system messages referring to "internal errors":

a) Switch the operating unit off, set the PLC to the STOP status and then start up both units again.

b) Download the configuration again and restart the operating unit and PLC.

c) If the fault occurs again, please contact your nearest Siemens representative. When doing so, please quote the number of the error that has occurred and any tags referred to in the message.

Message	Description	Cause / Remedy
01	COM bit not set	Connection interrupted, e.g. cable not plugged in, runtime is not running, IM/CP stopped.
02	Error bit set	Runtime has set error bit.
03	*Internal error*	
04	*Internal error*	
05	*Internal error*	
06	*Internal error*	
07	Invalid block length	When calling in the FB, a value was entered for the block length greater than 3.
08	Response block exceeds peripheral end address	The last byte of the response block is outside the peripheral address area. Address of IM/CP + Number of Outputs (dependent on block length selected) > 255.
09	Request block exceeds peripheral end address	The last byte of the request block is outside the peripheral address area. Address of IM/CP + Number of Inputs (dependent on block length selected) > 255.
10	Invalid periphery start address	Only with AG 95-DP: The FB only supports periphery addresses 64 to 127.
21	*Internal error*	
22	Address exceeds permissible address area	An address should be read which is greater than 255. This is not possible with this FB.
23	Writing in timer not permitted	It is required to write directly in a timer. This is not possible with this FB.
24	*Internal error*	
25	Writing in counter not permitted	It is required to write directly in a counter. This is not possible with this FB.

Message	Description	Cause / Remedy
26	*Internal error*	
27	*Internal error*	
30	DB does not exist	The DB to be read from or written to does not exist in the PLC.
31	DB too short	The data word to be read or written does not exist in the PLC in the DB specified.
F1	*Internal error*	

PLC Jobs

B

This section of the Appendix contains a list of all PLC jobs and their relevant parameters.

Description

PLC jobs can be used to initiate functions on the operating unit from the PLC, such as:
– displaying screens
– setting date and time
– altering general settings

A PLC job consists of 4 data words. The first data word contains the job number. Data words 2 to 4 are used to transfer up to three parameters depending on the function in question. The basic structure of a PLC job is shown in Figure B-1.

Address	Left byte (LB)	Right byte (RB)
Word 1	0	Job no.
Word 2	Parameter 1	
Word 3	Parameter 2	
Word 4	Parameter 3	

Figure B-1 Structure of a PLC job

List

All PLC jobs that are possible on the various operating units are listed below together with their parameters. The **No.** column indicates the PLC job number. In general, PLC jobs can only be initiated **by the PLC** when the operating unit is in online mode.

No.	Function			PC	OP37/Pro	MP270
14	**Set Time (BCD format)**			●	●	●
	Parameter 1	LB:	–			
		RB:	Hours (0..23)			
	Parameter 2	LB:	Minutes (0..59)			
		RB:	Seconds (0..59)			
	Parameter 3	–				
15	**Set Date (BCD format)**			●	●	●
	Parameter 1	LB:	–			
		RB:	Day of week (1..7: Sun day...Saturday)			
	Parameter 2	LB:	Day of month (1..31)			
		RB:	Month (1..12)			
	Parameter 3	LB:	Year			
23	**Set password level**			●	●	●
	Parameter 1	0..9 0 = Lowest password level 9 = Highest password level				
	Parameter 2, 3	–				
24	**Password logout**			●	●	●
	Parameter 1, 2, 3	–				
40	**Transfer date/time to PLC (Format: S7 DATE_AND_TIME)** There should be at least 5 seconds between two jobs or else the operating unit will become overloaded.			●	●	●
	Parameter 1, 2, 3	–				
41	**Date/Time for PLC dowmload (in OP/MP format)** There should be at least 5 seconds between two jobs or else the operating unit will become overloaded.			●	●	●
	Parameter 1, 2, 3	–				
42	**Get LED area from PLC**			–	●	●
	Parameter 1	Area pointer no.:	1..8			
	Parameter 2, 3	–				
43	**Get event message area from PLC**			●	●	●
	Parameter 1	Area pointer no.:	1..4 with PC 1..8 with OP37/Pro, MP270			
	Parameter 2, 3	–				
44	**Retrieve alarm message area and acknowledgement area from the PLC** This PLC job is used to retrieve both the alarm message area and the acknowledgement area PLC → Operating Unit from the PLC. If no acknowledgement area has been set up, only the alarm message area is retrieved.			●	●	●

No.	Function			PC	OP37/Pro	MP270
	Parameter 1	Area pointer no.:	1..4 with PC 1..8 with OP37/Pro, MP270			
	Parameter 2, 3	–				
49	**Clear event buffer**			●	●	●
	Parameter 1, 2, 3	–				
50	**Clear alarm buffer**			●	●	●
	Parameter 1, 2, 3	–				
51	**Select screen**			●	●	●
	Parameter 1	Screen number				
	Parameter 2	–				
	Parameter 3	–				

Interface Area Assignment

C

This appendix details the interface assignment for all plug-in connecting cables. They can also be ordered separately from Siemens.

Note

Siemens offers no guarantee for cables soldered by the user.

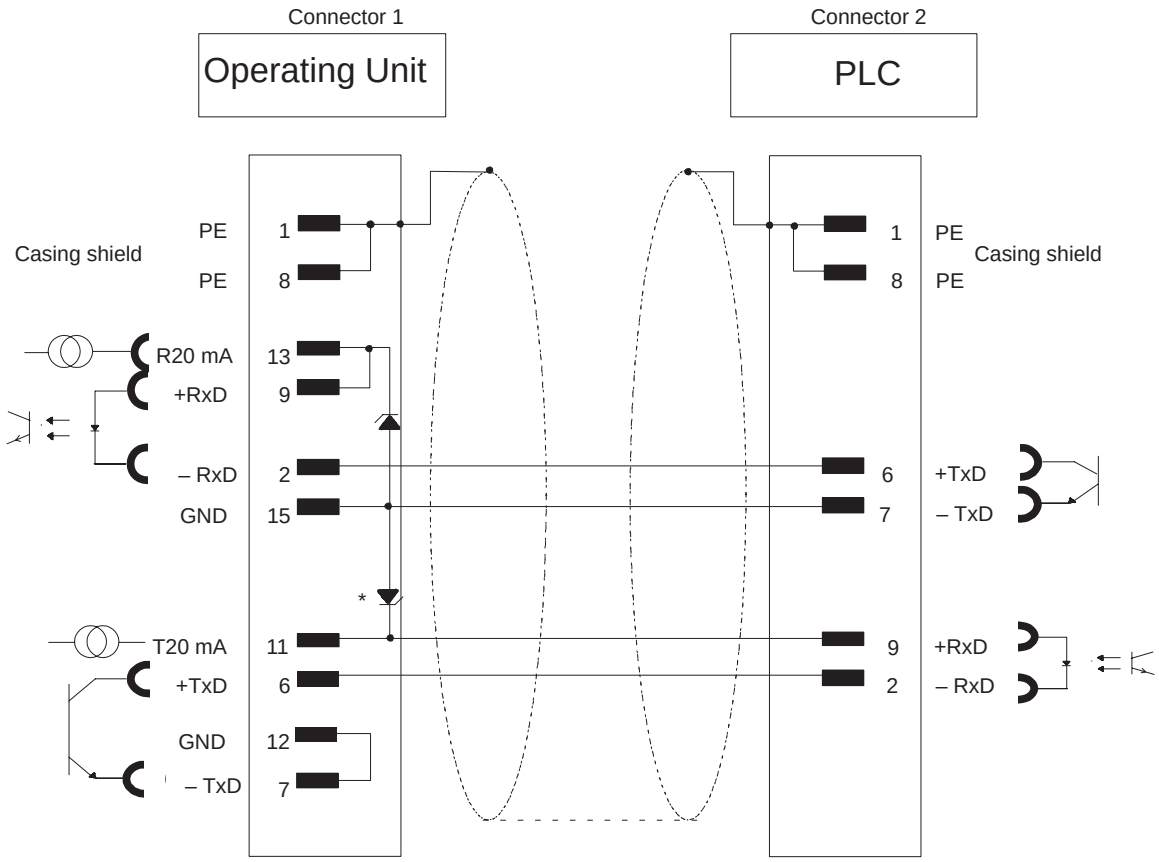
Plug–in Connecting Cable: Operating Unit <–> SIMATIC S5 (TTY) AS511

PU Interface on CPUs

6XV1440 – 2A...

Connector 1: 15–pin Sub D plug
Secured by slide
TTY, active

Connector 2: 15–pin Sub D plug
Secured by slide
TTY, passive



* For TTY cables with special lengths > 10 m, 2 Zener diodes (12 V) must be soldered in the 15–pin connector for the operating unit (TTY active):
BZX 55 C12 ser. no. 30095128

Shielding connected at both ends to casing with large contact area

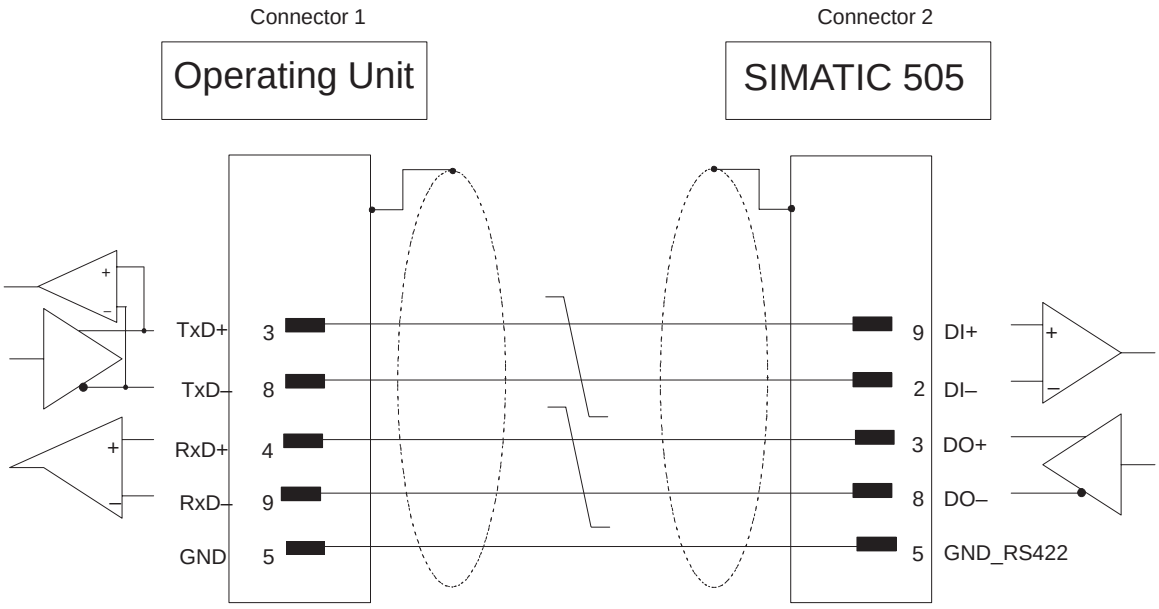
Cable: 5 x 0.14 mm^2; shielded; max. length 1000 m

Plug–in Connecting Cable: Operating Unit RS422 <–> SIMATIC 505 RS422

6 XV1440 – 1M... (PLC 545 / CPU 1102, 555)

Connector 1: 9–pin Sub D plug
Secured by screws
Cable outlet at Pin 1
RS422

Connector 2: 9–pin Sub D plug
Secured by screws
Cable outlet at Pin 1
RS422



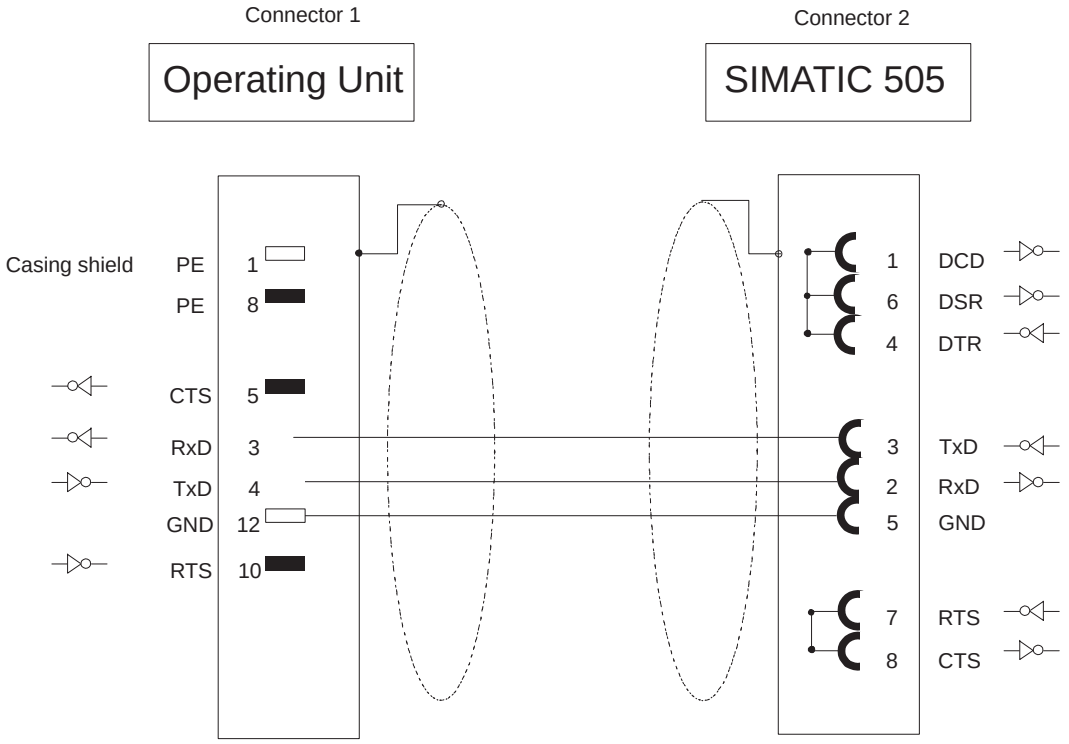
Shielding connected to casing with large contact area
Cable: 3 x 2 x 0.14 mm^2; shielded; max. length 300 m

Plug–in Connecting Cable: Operating Unit <–> SIMATIC 505

6 XV1440 – 2K...

Connector 1: 15–pin Sub D plug
Secured by slide
Cable outlet at Pin 1
Solid metal cover
V.24

Connector 2: 9–pin Sub D socket connector
Secured by screws
Cable outlet at Pin 1
V.24



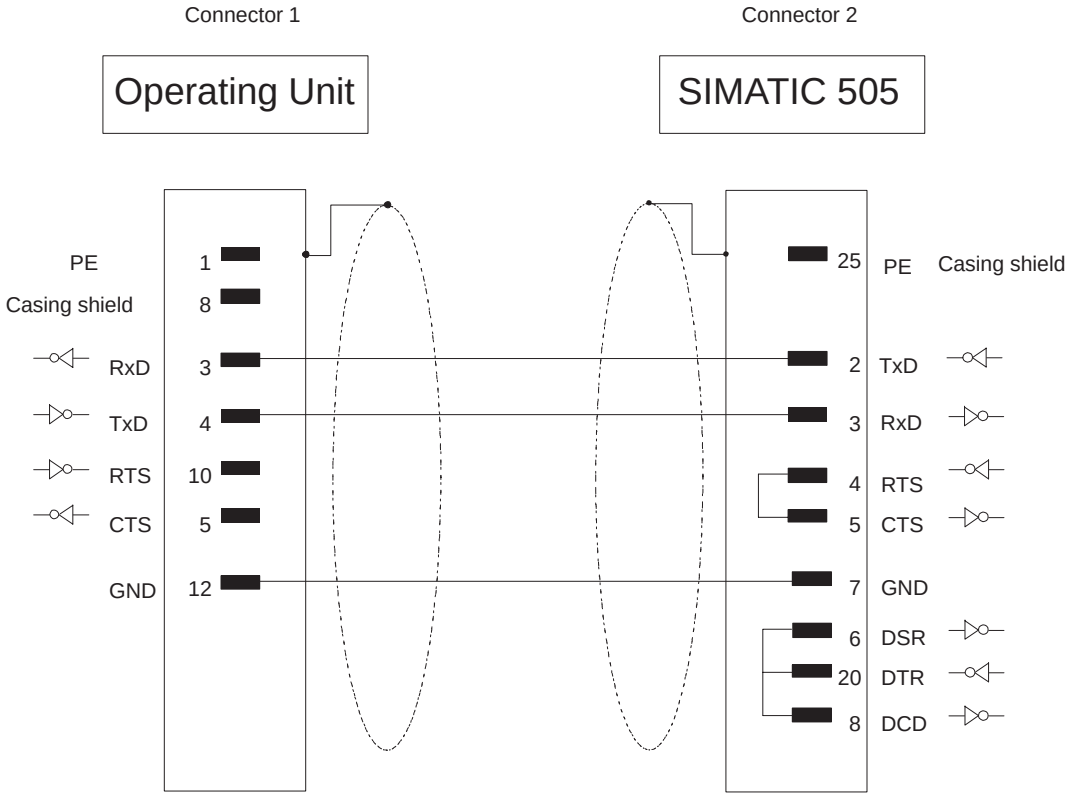
Shielding connected at both ends to casing with large contact area
Cable: 5 x 0.14 mm²; shielded; max. length 15 m

Plug–in Connecting Cable: Operating Unit <–> SIMATIC 505

6 XV1440 – 2L...

Connector 1: 15–pin Sub D plug
Secured by slide
Cable outlet at Pin 1
Solid metal cover
V.24

Connector 2: 25–pin Sub D plug
Secured by screws
Cable outlet at Pin 1
V.24



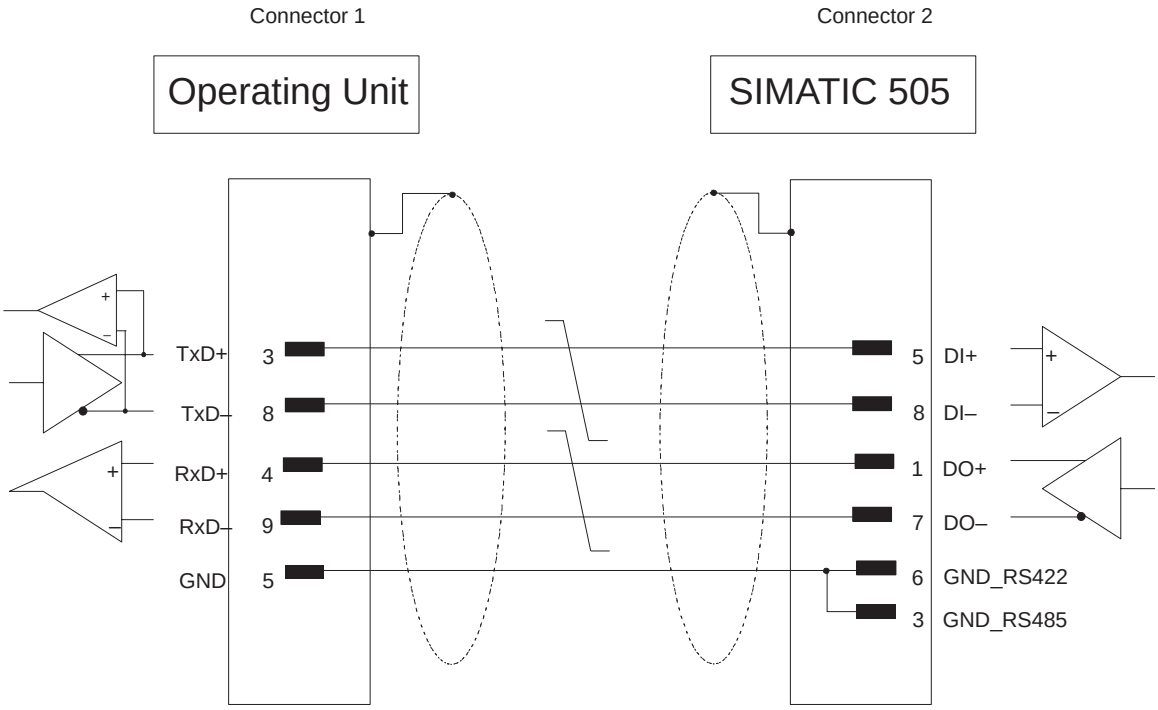
Shielding connected to casing with large contact area
Cable: 5 x 0.14 mm² shielded; max. length 15 m

Plug–in Connecting Cable: Operating Unit RS422 <–> SIMATIC 505 RS422

6 XV1440 – 2M... (PLC 525, 545 / CPU 1101, 565T)

Connector 1: 9–pin Sub D plug
Secured by screws
Cable outlet at Pin 1
RS422

Connector 2: 9–pin Sub D plug
Secured by screws
Cable outlet at Pin 1
RS422

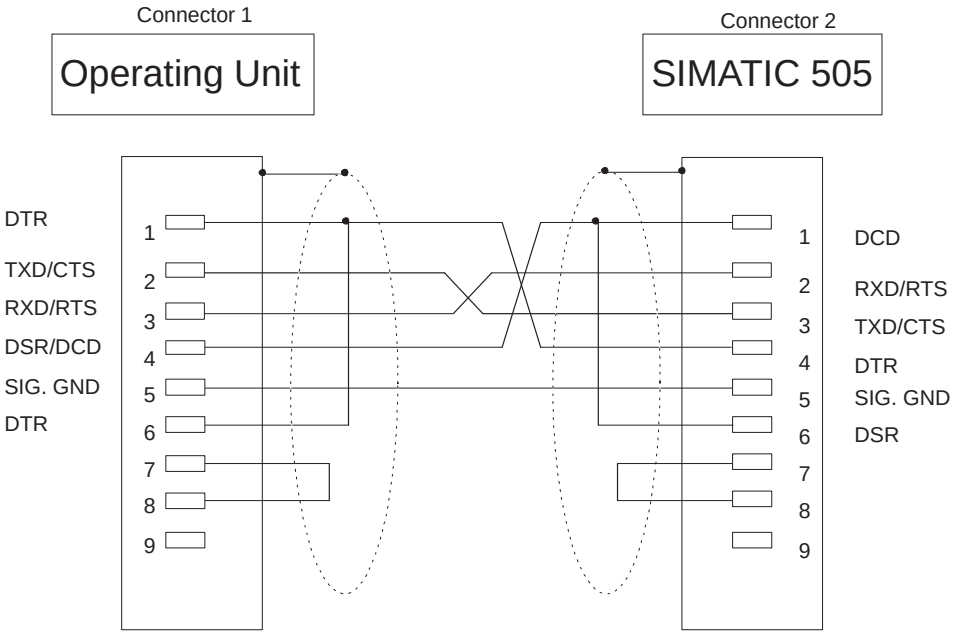


Shielding connected to casing with large contact area
Cable: 3 x 2 x 0.14 mm²; shielded; max. length 300 m

Plug–in Connecting Cable: Operating Unit <–> SIMATIC 505 RS 232-C

Connector 1: 9–pin Sub D plug
Secured by screws
Cable feed–out to rear

Connector 2: 9–pin Sub D plug
Secured by screws
Cable feed–out to rear

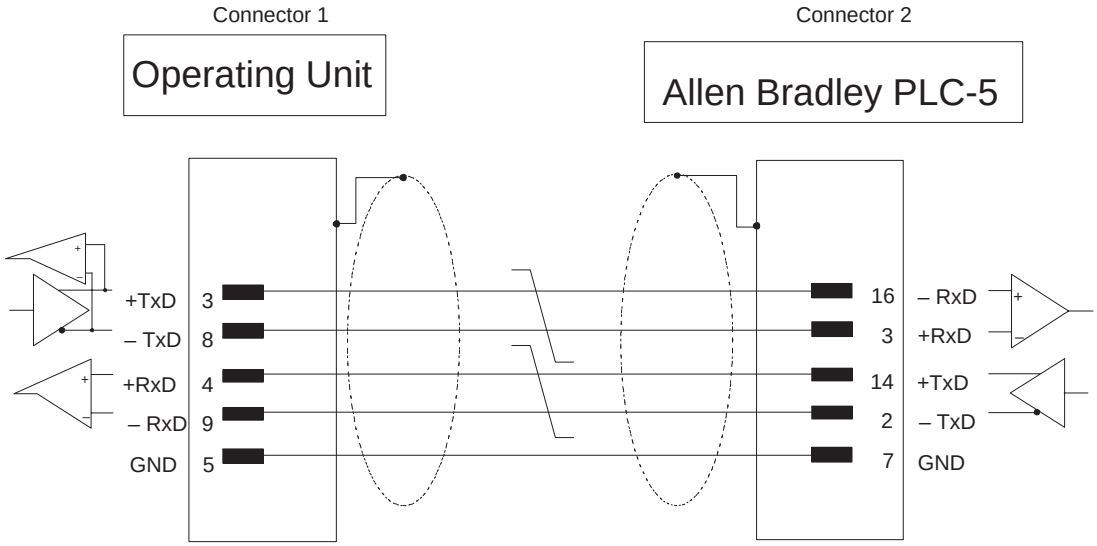


Plug–in Connecting Cable: Operating Unit <–> Allen Bradley PLC-5/RS422

6 XV1440 – 2V...

Connector 1: 9–pin Sub D plug
Secured by screws
Cable feed–out to rear

Connector 2: 25–pin Sub D plug
Secured by screws
Cable feed–out to rear



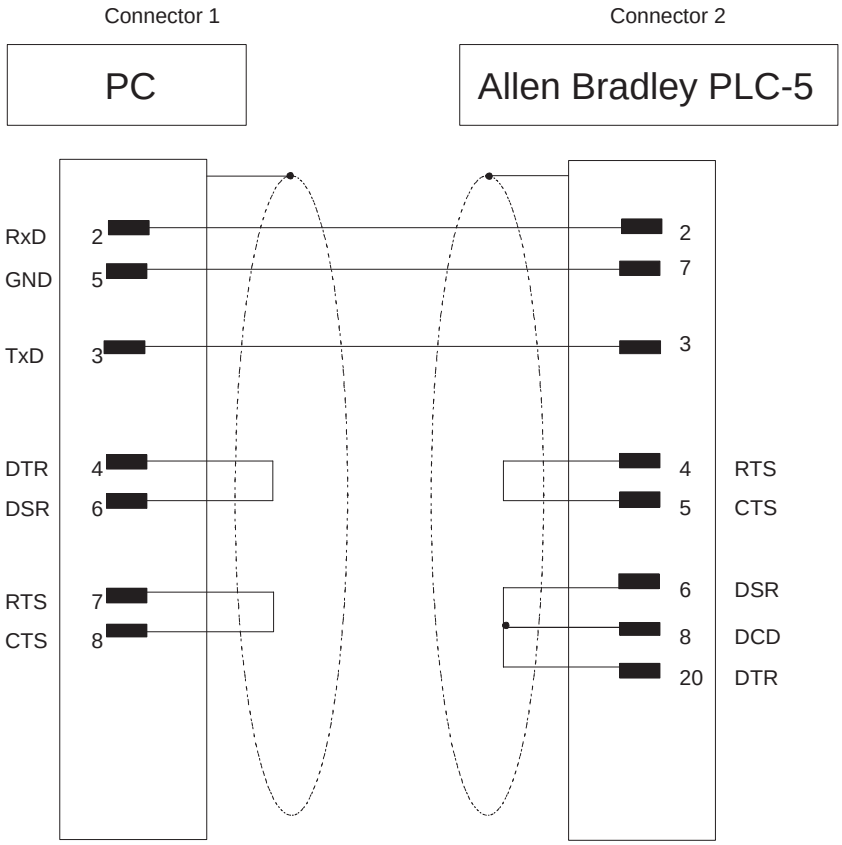
Cable 3 x 2 x 0.14 mm²; shielding contacts joined; max. length 60 m
Shielding connected at both ends to casing with large contact area

Plug–in Connecting Cable: PC <–> Allen Bradley PLC-5

Allen Bradley Standard Cable

Connector 1: 9–pin IBM AT socket connector
Secured by screws
Cable feed–out to rear

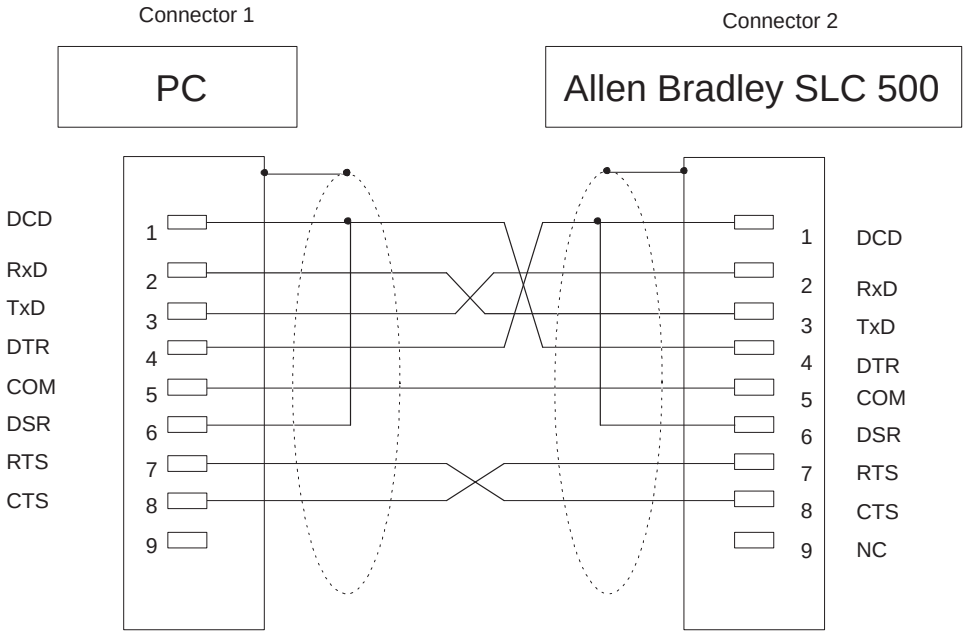
Connector 2: 25–pin PLC processor plug
Secured by screws
Cable feed–out to rear



Plug–in Connecting Cable: PC <–> Allen Bradley SLC 500

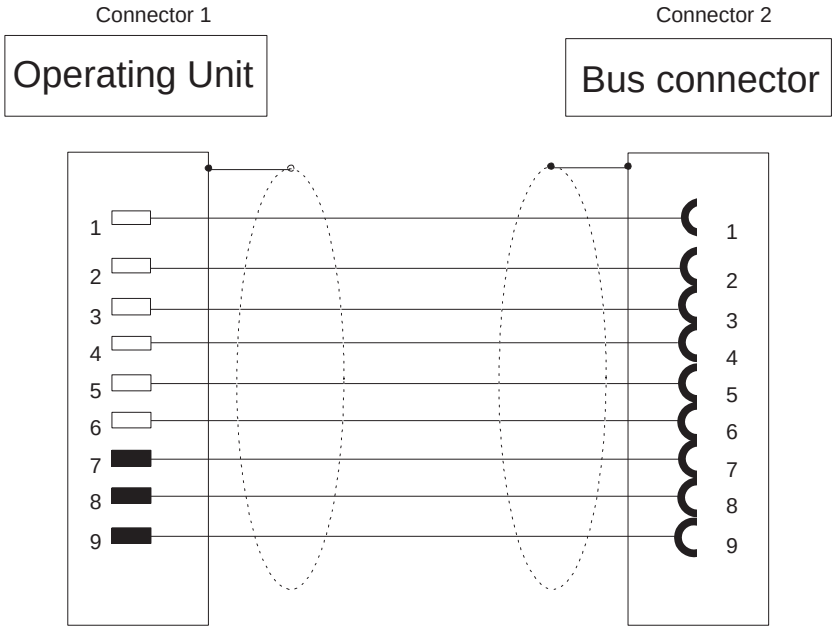
Connector 1: 9–pin Sub D plug
Secured by screws
Cable feed–out to rear

Connector 2: 9–pin Sub D plug
Secured by screws
Cable feed–out to rear



Adapter for PROFIBUS–DP Extension

6 XV1440 – 2T...



Cable: 9 x 5 mm2; shielded; max. length 32 cm
Shielding connected at both ends to casing with large contact area
Installation of multiple OP15s one under another (e.g. 3x6 = 18 units at intervals of 3 cm)
6XV1440–2TE10 cannot be used.

SIMATIC HMI Documentation

D

Target groups

This manual is part of the SIMATIC HMI documentation. The documentation is aimed at the following target groups:

- Newcomers
- Users
- Configurers
- Programmers
- Commissioning engineers

How the documentation is organized

The SIMATIC HMI documentation consists of the following components:

- User's Guides / User's Manuals for:
  - Configuration software
  - Runtime software
  - Communication between PLCs and operating units
- Equipment Manuals for the following operating units:
  - MP (Multi Panel)
  - OP (Operator Panel)
  - TP (Touch Panel)
  - TD (Text Display)
  - PP (Push Button Panel)
- Online Help on the configuration software
- Start–up Guides
- First Steps

Overview of complete documentation

The following table provides an overview of the SIMATIC HMI documentation and shows you when you require the different documents.

Documentation	Target Group	Content
First Steps with ProTool Product Brief	Newcomers	This documentation guides you step by step through the configuration of • a screen with various objects • changing from one screen to another • a message. This documentation is available for: • OP3, OP5, OP7, OP15, OP17 • OP25, OP27, OP35, OP37, TP27, TP37 • Windows-based systems
ProTool Configuring Windows-based Systems User's Guide	Configurers	Provides information on working with the ProTool/Pro configuration software. It contains • information on installation • basic principles of configuration • a detailed description of configurable objects and functions. This documentation is valid for Windows-based systems.
ProTool Configuring Graphics Displays User's Guide	Configurers	Provides information on working with the ProTool configuration software. It contains • information on installation • basic principles of configuration • a detailed description of configurable objects and functions. This documentation is valid for graphic display operating units.
ProTool Configuring Text-based Displays User's Guide	Configurers	Provides information on working with the ProTool/Lite configuration software. It contains • information on installation • basic principles of configuration • a detailed description of configurable objects and functions. This documentation is valid for text-based display operating units.
ProTool Online Help	Configurers	Provides information on the configuration computer while working with ProTool. Online Help contains • context-sensitive help • detailed instructions and examples • detailed information • all the information from the user guide.
ProTool/Pro Runtime User's Guide	Commissioning engineers, Users	Provides information on working with ProTool/Pro Runtime software. It contains • installation of the ProTool/Pro Runtime visualization software • commissioning and running the software on Windows-based systems.
Copy Protection Start–up Guide	Commissioning engineers, Users	The ProTool/Pro Runtime visualization software is a copyright product. This manual contains information on the installation, repair and uninstallation of authorizations.

Documentation	Target Group	Content
Application Example Start–up Guide	Newcomers	ProTool is supplied with example configurations and the corresponding PLC programs. This documentation describes how you • load the examplesonto the operating unit and PLC • run the examples and • upgrade the connection to the PLC to suit your own specific application.
MP270 Equipment Manual	Commissioning engineers, Users	Describes the hardware and the general operation of Multi Panel MP270. It contains • installation and commissioning instructions • a description of the equipment • operating instructions • instructions for connecting the PLC, printer and programming computer, • maintenance instructions.
OP37/Pro Equipment Manual	Commissioning engineers, Users	Describes the hardware, installation and inclusion of upgrades and options for the OP37/Pro.
TP27, TP37 Equipment Manual OP27, OP37 Equipment Manual OP25, OP35, OP45 Equipment Manual OP7, OP17 Equipment Manual OP5, OP15 Equipment Manual TD17 Equipment Manual	Commissioning engineers, Users	Describes the hardware and general operation. It contains • installation and commissioning instructions • operating unit description • connecting the PLC, printer and programming computer • operating modes • operation • description of the standard screens supplied with the operating unit and how to use them • fitting options • maintenance and fitting of spare parts.
OP3 Equipment Manual	Commissioning engineers, Users, Programmers	Describes the hardware of the OP3, its general operation and the connection to the SIMATIC S7.
PP7, PP17 Equipment Manual	Commissioning engineers, Users	Describes the hardware, installation and commissioning of push-button panels PP7 and PP17.
Communication User’s Manual	Programmers	Provides information on connecting text-based and graphics displays to the following PLCs: • SIMATIC S5 • SIMATIC S7 • SIMATIC 500/505 • drivers for other PLCs This documentation describes the • configuration and parameters required for connecting the devices to the PLC and the network • user data areas used for exchanging data between operationg unit and PLC.

Documentation	Target Group	Content
Communication for Windows-based Systems User's Manual	Programmers	Provides information on connecting Windows-based systems to the following PLCs: • SIMATIC S5 • SIMATIC S7 • SIMATIC 505 • Allen Bradley PLC 5/SLC 500 This documentation describes the • configuration and parameters required for connecting devices to the PLC and the network • user data areas used for exchanging data between operating unit and PLC.
Other PLCs Online Help	Programmers	Provides information on connecting devices to PLCs, such as: • Mitsubishi • Allen Bradley • Telemecanique • Modicon • Omron • SIMATIC WinLC When the drives are installed, the relevant Online Help is installed at the same time.
ProAgent for OP User's Manual	Configurers	Provides the following information about the ProAgent optional package (process diagnosis) for OPs • configuring system-specific process diagnosis • detecting, locating the cause of and eliminating process errors, • customizing standard diagnostic screens supplied with the software.

Siemens Worldwide

E

In this Appendix

In this appendix you will find a list of:

- All cities in the Federal Republic of Germany with Siemens Sales Offices and
- All European and non-European Siemens Companies and Representatives

Siemens Sales Offices in the Federal Republic of Germany

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Dresden	Rostock
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- Vienna

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- Liège

Siemens N. V.
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Bosnia-Herzegovina

Generalexport Predstavnistvo Sarajevo
- Sarajevo

Bulgaria

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Croatia

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- Zagreb

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or
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- Nicosia

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- Congleton
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- Luxemburg

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- Oslo
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- Katowice
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- Lisbon, Amadora
- Matosinhos
- Porto

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Siemens birou de consultatii tehnice
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Siemens AG

or

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Tanzania Electrical Services Ltd.
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Dimo Limited • Colombo
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OAV Representative Office • Hanoi
Yemen (Arab. Republic)
Tihama Tractors & Engineering Co., Ltd. or Siemens Resident Engineers • Sanaa

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Australia
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Siemens Ltd. • Auckland • Wellington

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